ILLUSTRATED
ELECTRICAL REVIEW
A Journal of Scientific and Electrical Progress.

VOL. 29. No. 7. WEEKLY.

NEW YORK, WEDNESDAY, AUGUST 12, 1896.

$3 PER ANNUM. Single Copies, 10 Cents.

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Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

A conductor on a trolley car in a Rhode Island town, when asked how the road was doing, replied that "business was badder than it were a year ago." It seems that the Boston atmosphere of good English does not extend as far as Rhode Island.

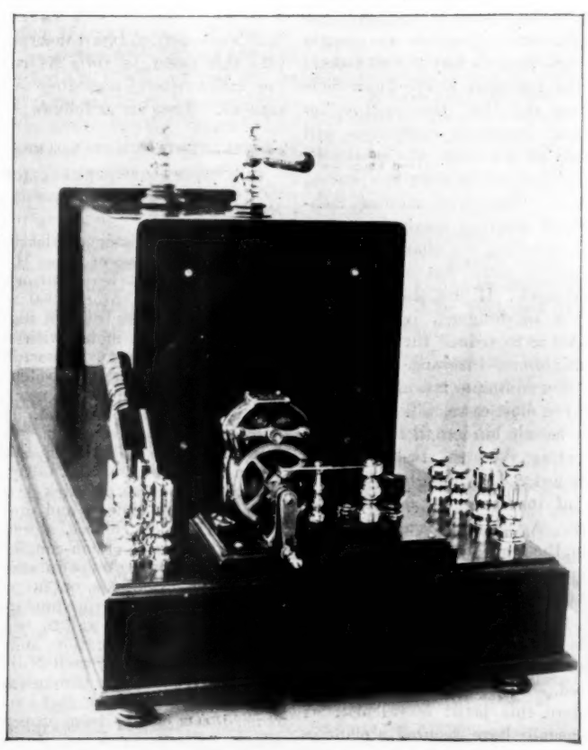
It was on a Summit street trailer, says a Kansas City paper, and the young mother was absent-mindedly gazing on a far-off blue-capped height and carelessly toying with a pink-tinted transfer check in her right hand. The baby had asked for the pretty ticket, but the mother's thoughts were busy elsewhere. She kept on looking out over the landscape, evidently in a brown study. "Fares, please!" It was the conductor. The mother came back to the present tense with a jump. "I paid my fare once." "No, mam, you didn't, beggin' your pardin'." "Yes I did. I had a trans——." Just then the baby began to gag and grow black in the face. And not only black, but all about her little mouth were remarkable variegations in shades of pink. The transfer ticket had returned to the pulp from which it was made. The mother scooped out what was left of it from baby's mouth, thumped the little one's back to aid it in recovering its breath, and then turned a very red face toward the conductor in mute inquiry as to what was to be done. The conductor said never a word. He merely held out his hand. "Well, I won't pay again. I—I—I'll walk first." The conductor gave the gripman one bell. All the passengers looked their sympathy as the mother and the variegated little one left the car.

In last week's Electrical Review appeared an article credited to the Philadelphia *Times*, describing Mr. Tapley W. Young's apparatus for thawing out oil wells. In the last paragraph of the article it is stated that the apparatus is controlled by the Standard Oil Company. Mr. Young writes that this is not a fact, but that otherwise the article gives a correct description of his device.

A foreign exchange says that King Menelik, of Abyssinia, has commissioned a Belgian engineer to erect a telegraph and telephone system in Abyssinia, which is to connect all the more important points in the country. Each telegraph station is to have a telephone, and the more important are to be connected with the king's residence.

It has been recently stated on good authority, says London *Lightning*, that there are at work or under construction in Canada 36 electric street railroads, with a total length of nearly 600 miles. No less than 750 motor cars are in use or building, and the sum invested in the various undertakings is a little over four millions sterling. England in the meantime is just beginning to wake up, rub her eyes, and wonder whether the horse-tram could really be improved upon, and whether ½*d.* a mile running costs, with speed, cleanliness and comfort, are, on the whole, preferable to 7*d.* a mile running costs, polluted streets, frowsy 'buses, the traveling powers of a gouty tortoise and the horrors of cruelty to animals. "But," says the dear old grandmother of nations, "we might hurt somebody, or frighten a dog; and then, after all, we have got on without these things so far," and she dozes again.

It is said that the water power at Fairfield, Me., will be used to develop electric current. About 2,000 horse-power is available.



Edwards's New Induction Coil.

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The new 12-inch Ruhmkorff induction coils which are being constructed by Messrs. Edwards & Company, of 144th street and Fourth avenue, New York city, are an important addition to the X-ray apparatus now on the market. This coil has features for which excellent results are claimed. All the fittings are of bronze, and the dimensions are as follows: Width, 15⅓ inches; length, 3 feet 4 inches; height, 20 inches.

With the view of reducing the potential difference between adjacent layers and sections of wire, the secondary winding is divided by rubber disks into 12 sections, and double-covered silk wire is used to insure perfect insulation in the highest degree. The interrupter consists of a small electric motor which can be operated with facility by hand.

The platinum contact points are so arranged that they can be readily renewed and are unusually heavy. The apparatus is mounted in a heavy, hard-rubber case, on a polished mahogany base, and weighs approximately 175 pounds. The illustration herewith shows the general construction of the apparatus.

A New Illuminant.

The London correspondent of the Manchester *Courier* publishes a remarkable account of a new illuminant, which, if all that is said of it is true, will push both gas and electric light very hard. For its production no machinery is required save that contained in a portable lamp neither larger nor heavier than is used with colza oil or paraffine. This lamp, it is declared, generates its own gas. The substance employed is at present a secret, jealously guarded by some inventive Italians. The cost is declared to be at most one-fifth of that of ordinary gas, and the resultant light is nearly as bright as the electric light and much whiter. A single lamp floods a large room with light. The apparatus can be carried about as easily as a candlestick and seems both clean and odorless.

THE INSURANCE OF ELECTRICAL PLANTS.

BY R. H. PIERCE BEFORE THE NORTHWESTERN ELECTRICAL ASSOCIATION.

One of the most serious problems to the owner or manager of a central station is the reducing of the fire hazard to a minimum.

A loss by fire means loss of plant, loss of revenue during the time of shut-down and the loss of patronage due to the loss of public confidence in the reliability of the plant. This last loss is by no means the least serious, as reliability is one of the chief requirements in a system for distributing light and power, and to many consumers it is the first and chief consideration.

As a good share of the existing stations need to be rebuilt in order to have a decent earning capacity, the loss of plant may, in many cases, be considered less of a hardship than the losses through interruption of service and the attendant loss of revenue and patronage.

The problem of safety is then the real question, and when this is solved, we, at the same time, solve the problem of insurance.

In the opinion of the writer, the insurance question, which the central station manager has to answer, is simply the question of making his plant insurable. This may appear to be a radical view, but I believe it is logical. I thoroughly appreciate the fact that insurance is a serious matter to many of the members of this society, and I believe I am thoroughly familiar with the conditions which make it a serious matter. Many plants in this territory are located in towns where all insurance is expensive. Many plants have been located without regard to either external exposure or external fire protection. A large proportion of existing plants were installed at a time when the electrical manufacturers and electrical constructors did not understand what materials and methods should be used in order to secure safety, and, finally—and worst of all—many plants have been installed by companies or individuals whose only thought was to get the largest prices for the cheapest installation, leaving the unfortunate station owners and managers to wrestle with the question of safety, as well as those of reliability and economy. But, however serious the question may be, it must be met, and, if attacked in the right way, the solution may not be as difficult as it at first appears.

As before stated, the results of a central station fire are two-fold. First, there are the losses due to interruption of service, and, second, there is the loss of plant. I have placed the losses due to interruption of service first, as these must be considered whether we consider the question of insurance or not. The interruption of service for any considerable time or a decrease in patronage, due to irregular or uncertain service, may, and often does, mean a difference in revenue, which is the difference between a profit and a loss in the operation of the station, and operating a station at a loss is worse than losing it.

The way to secure safety and reliability is to have proper construction and proper care, protection and attendance. The proper methods for securing safety are laid down in the rules and requirements of the National Board of Fire Underwriters, and are well known to all engineers and constructors of any standing.

The question of insurance can be met in three ways:

1. By insuring in responsible and reliable insurance companies.

2. By the formation of a mutual company by central station owners.

3. By securing the maximum safety through the use of proper construction, care and fire protection, and taking the chances of a fire loss. As a general proposition, the only reasonable course is the first one indicated; *i. e.*, the insuring in responsible and reliable companies. The plan of forcing a central station owner's mutual has been "weighed in the balance and found wanting." Theoretically, it may be possible to form such a mutual company, but it would be an additional burden to the central station business, which, I take it, has trouble and problems enough to face already. If fire insurance is a legitimate business—and it appears to be as legitimate a business as electric lighting—then we may as well assume that the insurance people know their business and that the competition between insurance companies will produce as low a rate as could, with equal protection, be given by a mutual company. The third method mentioned, of securing maximum safety and then taking the chances, may be the best in some, but only in very special cases. If the central station plant is so designed, installed and operated as to reduce the fire hazard to a minimum, Insurance companies will ask a minimum rate of insurance, which, in most cases, will be so small as to be no burden to the owners. Discarding then the two plans just mentioned, we are brought to the first plan of insurance in reliable companies. Accepting this as our line of action, the problem now is to so install and operate our plants that the hazard is reduced to a minimum or at least to a point where further improvements would increase the cost out of proportion to the additional safety secured.

Before this point is reached, we will usually have secured a plant in which the fire hazard is very small and on which the insurance rate should be surprisingly low. We must not figure too close on our investment. Even if the interest on the added investment is equal to the amount saved by reduction of premium, we are ahead, as the improved construction, care and attendance means a smaller chance of interruption of service and usually better service, less repairs and smaller depreciation.

The great problem is, as I have said, how to best secure safety. Competition in the electrical manufacturing and construction business has not lead to increased safety. On the contrary, it has lead to cheapness in both appliances and methods, and cheapness does not mean safety. On the other hand, we must not think that we must be extravagant in order to have safety. The use of proper methods of construction and of intelligence and care in operation are what is most necessary to secure safety. If, however, we can not look to the electrical companies for protection, to whom shall we look? Who should judge of what is necessary for safety? Who has devoted most time and thought to this subject? The National Board of Fire Underwriters beyond a doubt. Whether we insure or not, the regulations of the underwriters are to-day the best and, we may say, the only guide to safety. There requirements can, of course, be improved, but the insurance people are ready and anxious to receive suggestions from all engineers and central station men. I sincerely believe that a study of the requirements of the underwriters, and a free discussion of their merits by central station men and engineers, is the one thing that will lead to an understanding of the insurance question and will eventually lead to an understanding between owners and insurance companies which will be mutually satisfactory.

By way of starting such a discussion in this association, I have incorporated into this paper, in full, the rules of the underwriters regarding central stations. They are as follows:

REQUIREMENTS FOR STANDARD ELECTRIC LIGHT AND POWER STATIONS.

Building:

Walls, brick or stone, at least eight inches in thickness, or iron. Height, one story, without basement or space below. Area, not over 5,000 square feet of ground area between standard fire walls. Roof, metal, with metal trusses and supports. Floor, brick, cement, stone or earth. Wooden platforms may be used about machines. Cornice, brick, stone or metal. Eaves, not less than 15 feet from ground. Finish, no combustible finish, or finish leaving concealed spaces. Division walls, if any, to be of brick or stone, with standard fire doors and shutters. Partitions, about offices, storerooms or elsewhere. to be of non-combustible material. Boiler, except in standard station, to be outside, or cut off by standard fire wall with standard fire doors and shutters; wall to be eight inches for one story station, and four inches to be added for each additional story; wall to extend through and at least three feet above roof—roof of boiler house should have proper ventilator. Stack, brick, or, if iron, to be outside and on brick foundation. Wire tower, if any, to be brick or stone, with same kind of roof as station proper. Stairs, if any, to be properly inclosed, when deemed necessary. Elevators, if any, to be in brick tower or with self-closing hatches. Heating, to be by steam, hot water or hot air by blower system; piping for same to be free from wood work and supported by iron hangers; stoves may be used in office. Lighting, to be by gas, brackets so arranged as not to allow flame to come in contact with woodwork; or by electricity, wiring to be in accordance with rules. Occupancy, only for the legitimate uses of the station itself. Exposure, unexposed within 50 feet, or, if exposed, to have approved fire walls on exposed sides.

Electrical Arrangements:

Generators. (a) Must be located in a dry place. (b) Must be insulated on floors or base frames, which must be kept filled to prevent absorption of moisture and also kept clean and dry. Where frame insulation is impossible, the inspector may, in writing, permit its omission, in which case the frame must be permanently and effectively grounded. (c) Must never be placed in a room where any hazardous process is carried on, nor in places where they would be exposed to inflammable gases or flyings of combustible material. (d) Must each be provided with a waterproof covering. Conductors, from generators, switchboards, rheostats or other instruments, and thence to outside lines, conductors—(a) Must be in plain sight or readily accessible. (b) Must be wholly on non-combustible insulators, such as glass or porcelain. (c) Must be separated from contact with floors, partitions or walls, through which they may pass, by non-combustible insulating tubes, such as glass or porcelain. (d) Must be kept rigidly so far apart that they can not come in contact. (e) Must be covered with non-inflammable insulating material sufficient to prevent accidental contact, except that "bus bars" may be made of bare metal. (f) Must have ample carrying capacity to prevent heating. (See table of capacity of wires, page 22.) (g) Must, where leaving the building, be looped downward, and the tube in which they are inclosed be inclined so as to prevent the entrance of rain water along the wires. (h) Must be provided with a safety fuse or automatic circuit-breaker on a non-combustible base for each feeder and primary main. (i) All wire connections must be soldered to secure good contact, excepting approved screw contacts. (j) Must have branch wires for station lighting installed in accordance with the rules for electric light and power wiring. Switchboards—(a) Must be so placed as to reduce to a minimum the danger of communicating fire to adjacent combustible material. Special attention is called to the fact that switchboards should not be built down to the floor, nor up to the ceiling, but a space of at least 18 inches, or two feet, should be left between the floor and the board, and between the ceiling and the board, in order to prevent fire from communicating from the switchboard to the floor or ceiling, and also to prevent the forming of a partially concealed space, very liable to be used for storage or rubbish and oily waste. (b) Must be accessible from all sides when the connections are on the back, or may be placed against a brick or stone wall when the wiring is entirely on the face. (c) Must be kept free from moisture. (d) Must be made of non-combustible material, or of hardwood in skeleton form, filled to prevent absorption of moisture. (e) Bus bars must be equipped in accordance with Rule 3 for placing conductors. Resistance boxes and equalizers—(a) Must be equipped with metal or other non-combustible frames. The word frame in this section relates to the entire case and surroundings of the rheostat and not alone to the upholding supports. (b) Must be placed on the switchboard, or, if not thereon, at a distance of a foot from combustible material, or separated therefrom by a non-inflammable, non-absorptive, insulating material. Lightning arresters—(a) Must be attached to each side of every overhead circuit connected with the station. (b) Must be mounted on non-combustible bases in plain sight on the switchboard, or in

any equally accessible place, away from combustible material. (c) Must be connected with at least two "earths" by separate metallic strips or wires having a conductivity not less than that of a No. 6 B. & S. wire. These strips or wires must be run as nearly as possible in a straight line from the arresters to the earth connection. (d) Must be so constructed as not to maintain an arc after the discharge has passed, and must have no moving parts. It is recommended to all electric light and power companies that arresters be connected at intervals over systems in such numbers and so located as to prevent ordinary discharges entering, over the wires, buildings connected to the lines. In general, all apparatus must be maintained in good condition and, together with all wiring, must conform with rules for safe wiring.

Care and Attendance:

Attendant — A competent man must be kept on duty in the rooms where generators are operating. Waste cans—Oily waste must be kept in approved metal cans and removed daily. Approved waste cans shall be made of metal, with legs raising cans three inches from the floor and with self-closing covers. Oils, gasoline, etc.—Oil must not be allowed to accumulate on the floor. No oils, varnish, turpentine, alcohol, gasoline, benzine or similar articles shall be stored in the building, and no gasoline soldering pots to be used or kept in the building. Ashes—Ashes must not be kept in combustible receptacles, and must be removed from station daily. Coal—Soft coal or charcoal not to be stored in station near the boilers. Storeroom—Rooms occupied for the storage of supplies, testing or repairs must be kept in a clean and orderly manner.

Fire Protection, Internal:

Fire Pails — Three (3) to each 3,000 square feet of floor area, but not less than 12 in any station. Pails to be painted red, with the word "Fire" in black letters two inches long on side thereof. One-half the number of pails kept filled with dry sand, and one-half with clean water. Small Hose—Fifty to 100 feet of one-inch linen hose to each 5,000 square feet of floor area. Hose to be provided with ⅜-inch nozzle, to be in lengths of not over 50 feet, and to be kept folded, not rolled, and attached to standpipe, with at least one opening with hose attached on each floor, which shall have an adequate supply of water at not less than 25 pounds pressure; if supply is from tank, capacity of tank to be not less than 1,000 gallons to each 5,000 square feet of ground area.

External:

Water Supply—There must be two double hydrants connected with not less than a six-inch main, within 600 feet of the building.

NOTE: If unexposed, and not over 5,000 square feet ground area, two single hydrants on four-inch main would be satisfactory.

Fire Department—There must be a fire department house, with permanent men and horses stationed therein, and at least 1,000 feet of hose kept therein, within one-half mile of the building; the said house must also contain steamer, unless water pressure is at least 60 pounds at the building.

Fire Alarm—Telegraph fire-alarm station to be within 250 feet of building. Unless keyless box, there must be a key at the building.

Every one of the foregoing rules represents thought, investigation and experience, and if time permitted, it would be profitable for us to discuss each rule by itself. I shall have to be content, however, with calling attention to the rules and to a few lessons which they seem to teach. If a central station conforms to all the requirements of the foregoing rules, the insurance rate is very low, and even at the low rate, its insurance is eagerly sought by insurance companies as desirable business.

The base rate or the rate of insurance for central stations which conform in all respects to the requirements of the underwriters, is 50 cents per $100. For every point in which a station fails to conform to the requirements, a certain addition is made to the rate.

The underwriters recognize 34 specific causes for raising the rate above the base or minimum amount. These causes are violations of the rules and regulations, and do not consider "external fire protection," "other occupancy," "condition," "exposure." A specific addition is made to the rate for inadequate fire protection, and an addition is made for other occupancy, condition, exposure, according to hazard. The 34 causes just mentioned are all violations of the regulations concerning construction of building, electrical arrangements, or care and attendance, and are therefore all causes within the control of the owner.

These 34 causes may, if they all exist, raise the rate to over $10 per $100, but of this sum over $5, or more than one-half the amount, is due to the following causes: Improper arrangement of stack, defective wiring, improper construction of switchboard, improper construction and placing of rheostats, storage of oils, gasoline, etc., in station, and improper storage of ashes. All of these are defects that should and always can be avoided and usually at small expense.

Time does not admit of taking up the 34 violations separately, but I can cover the ground in a general way by saying that if a station was built and operated so as to be defective under all or the majority of the 34 counts, any intelligent man would consider that it was only a question of time when it would burn down. The additions to the rate are not unreasonable. The causes for which the greatest additions are made to the rate are conditions which no sensible man would allow to exist in his station. In most cases a station can be designed or remodeled by one familiar with the underwriter requirements so as to have a very low total rate and without any extravagant expenditure; and where the surroundings are favorable, a station can be cheaply built which can be insured for the minimum rate or very close to it.

The conclusion which I hope can be drawn from my remarks, is that the solution of the insurance problem is intelligent construction and operation, and that the way for us to determine how to design, install and operate plants, and how to improve existing plants, is to carefully study and freely discuss the requirements of the National Board of Fire Underwriters, and then apply the right principles and methods to the plants which we are designing or operating.

Boston Electric Light Company's Annual Report.

The annual report of the Boston, Mass., Electric Light Company for the year ended June 30, 1896, makes the following showing:

	1896.	1895.	Increase.
Total income	$660,973	$610,265	$50,708
Operating expenses	420,641	411,449	9,192
Net	*240,332	198,815	41,582
Charges	50,717	31,845	18,872
Dividends	136,000	136,000	.....
Surplus	53,680	30,970	22,710

* Includes $66 premium paid on bonds retired.

The balance sheet shows cash on hand, $21,265; materials and supplies, $59,130; accounts and notes receivable, $103,211; notes and accounts payable, $328,363; balance to credit, profit and loss, $281,206.

The company offers $270,500 of its five per cent consolidated bonds now in its treasury to stockholders at par and interest, and to the public at 102 and interest.

President F. A. Gilbert has issued a circular to stockholders under date of July 30, in which he says:

The net earnings of the company have been larger during the past year than ever before in the history of the corporation, and a large sum has been appropriated from net profits to the payment of the company's obligations.

The directors are of the opinion that for a short time, at any rate, it will be advisable, as suggested by the Gas Commissioners, for the company to pay a somewhat smaller dividend, say at the rate of six per cent per annum, applying the balance of the profits to the liquidation of floating indebtedness and the cost of future additions and improvements. They believe that this will increase the value of the company's stock and bonds. The valuation of the real estate of the company has been increased by appraisal by more than $100,000.

PERSONAL.

Mr. T. C. Martin, editor of the *Electrical Engineer*, returned from Europe to New York last Friday on the "St. Paul."

Mr. J. P. Barrett has resigned from the presidency of the *Electrical Journal*, of Chicago, and has severed his connection with electrical journalism.

Thos. F. Clohesey, electrical engineer at Cincinnati, has completed plans and specifications for the fire department underground cable system to be installed in that city.

M. Berthelot, the well known French scientist, has received the Grand Cross of the Legion of Honor for his researches in chemistry. M. Berthelot is Minister of Foreign Affairs for France.

Gen. E. P. Meaney, well known in electrical circles and a sound money Democratic delegate to the Chicago convention, has retired with honor and promptness from the local New Jersey organization which declared for the free-silver platform.

Mr. James E. Keelyn, president of the Western Telephone Construction Company, of Chicago, is on his way East and will be at the Astor House, New York, the last two weeks in August. Mr. Keelyn is brought to the city to meet a number of interested parties and arrange for important telephone extensions.

Wall Street and McKinley.

A New York broker gives his opinion as follows on some Wall street stocks:

"I believe that a man might very well invest $6,000 in 100 Pacific Mail, 100 Kansas & Texas preferred and 100 General Electric at present prices. Suppose that Mr. Bryan were elected, there need not necessarily be much decline in General Electric, as its gold obligations are very small, while Pacific Mail would not suffer at all, as it has no gold obligations whatever, and is free of floating debt. Suppose, however, that in the panic these stocks did decline to an average of, say, 15 apiece, this would be about as much as one would have to fear. On the other hand, if the election goes right, it would not be very long before they sell at an average of 30 apiece. In other words, a man who buys stocks gets practically odds of 2 to 1 against Mr. McKinley's election, while, as we all know, the market odds are 2 to 1 on it. The way it looks to me is that the Street, as measured by prices on the Exchange, is really laying odds against McKinley."

The Electrical Stock Market.

Nearly one-half of the transactions last week on the New York stock exchange were made on Thursday and Friday, when 600,000 shares changed hands. There were heavy declines in a number of important stocks during the week. Manhattan railway suffered a net decline for the six days of 11½ points, foreshadowing a reduction in its dividend rate.

On Saturday, 1,300 shares of General Electric changed hands. This stock opened for the day at 21½, went to 22 and closed at 21½ bid and 21¾ asked. As compared with the prices for August 1, the whole list of stocks closed at lower figures.

The closing prices for electrical stocks on the Boston exchange last Saturday were as follows:

	Bid.	*Asked.*
Edison Electric Illuminating	135	140
General Electric	21	22
General Electric preferred	..	55
Lamson Consolidated Store Service	16	17¼
Westinghouse Electric preferred	48	49
Fort Wayne Electric	1	2
Fort Wayne Electric Trust (series A)	2	4
Thomson-Houston (series D)	3½	4¼

Electrical Yachtsmen.

Some well known electrical men who are enthusiastic yachtsmen are Mr. E. H. Bennett, Jr., president of the Diehl Manufacturing Company, of Elizabethport, N. J., who occasionally dodges business by a cruise on the steam yacht "Reverie." Mr. Roger Upton, president of the Standard Thermometer and Electric Company, is the owner of the sloop "Mystery," formerly owned by the Popes, of Columbia bicycle fame. Mr. Hooker, general manager of the Perkins Electric Switch Manufacturing Company, cruises on Long Island Sound in a "Newport cat." H. D. Bayne, of H. D. Bayne & Company, the electrical engineering company, enjoys deep water sailing in a schooner of the pilot-boat build.

It is stated that X rays have been used to take radiographs of flowers. They show the ovules inside the ovary in an unopened bud, the seeds within a seed vessel, and even the veins upon the white petals of a flower.

Improvements in Thermo-electric Batteries.

To the Editor of Electrical Review:

How to transform heat into electricity, economically, is considered the greatest and most promising problem that can engage the attention of inventors. In the year 1821, Professor Seebeck, of Berlin, Germany, discovered that by joining the ends of two unlike metals and keeping one pair of junctions at a higher temperature than the other pair, an electric current was generated at the junctions of the metals. Antimony and bismuth are the metals frequently employed in the generation of thermo-electric currents. By joining the antimony of one pair to the bismuth of the next and so on throughout a long series, a current of electricity having a fairly high tension can be generated. Many varieties of the thermo-electric battery have been made, but in all there is a very great waste of heat. Perhaps the most economical thermo-electric battery in existence transforms less than one per cent of the total heat energy of the fuel into electricity. Clamond, of Paris, has obtained, perhaps, better results than any other inventor in the attempt to generate electricity directly and economically from fuel. His battery consists in sheets of tinned sheet-iron and blocks of a certain alloy. The sheet-iron and the alloy are joined together, by having the end of the sheet-iron bent and punched, then casting the block of alloy round it, thus making a good metallic contact or connection. Rings of these elements are superposed on a furnace, the products of combustion from which first rise through an inner pipe, then descend along the inner ends of the elements, from which, however, they are separated by a metallic tube, to prevent corrosion of the ends of the elements by the products of combustion from the furnace. Clamond uses gas for fuel in the furnaces of the smaller, and coke in the furnaces of his larger, thermo-electric batteries. The electrical output is, probably, about one twentieth only of that which would be yielded by a dynamo driven by a steam engine whose boiler uses an equal quantity of fuel.

Let us consider where the great waste of heat occurs in the thermo-electric batteries which have hitherto been constructed. In the first place, there is an enormous waste of heat from the chimney, where there is one, as in Clamond's thermo-electric battery. From the chimney of an ordinary steam boiler, half the heat of the fuel escapes in the products of combustion. It is probable that from the chimneys of thermo-electric batteries which have hitherto been made, the waste of heat is even greater than this. In the furnaces of steam boilers it is well known that, when built on a large scale, the loss of heat is relatively less than it is in small boiler furnaces. Similarly, the quantity of heat escaping from the chimney of a thermo-electric battery is, perhaps, about equal to that which escapes from the chimney of a small boiler, or from that of a heating stove, which consumes an equal quantity of fuel in an equal time. The thermo-electric battery, in fact, is sometimes used as a stove. When so used, it is not altogether so very inefficient, because heat is needed anyhow. It is, however, very inefficient as a generator of electricity. It stands, therefore, in regard to economy of fuel for heating, on about an equal footing with the common heating stove. Nearly one fourth of the heat is radiated from the stove. Nearly all the rest, or about three fourths, passes up the chimney and does no useful work, except the production of a draught of air for supplying the furnace. In Clamond's battery, say 24 per cent of the heat may be carried off by radiation and convection of air currents from the battery, one per cent may be transformed into electricity and 75 per cent may escape at the chimney. How can we expect a great percentage in the output of electricity, when in most of the thermo-electric batteries which have been made, say 75 per cent of the heat escapes up the chimney, and of the remainder, or 25 per cent, by far the greater part is wasted by radiation into space and by atmospheric convection?

Now, the greatest problem that can engage the mind of man is how to avoid the enormous waste of heat in the thermo-electric battery. The writer, after much thought, has devised the following methods of securing good economy in the Clamond type of thermo-electric battery, which uses no water and which has a chimney.

First method. All the air which feeds the furnace is caused to pass within a casing along and in contact with the ends of the elements which need to be cooled, and then it enters the furnace at an elevated temperature. Thus the heat that would have otherwise been wasted is returned to the furnace, and part of the waste is thereby avoided. In fact, in this method I apply the regenerative principle to the thermo-electric battery. This method will not enable us to save all the heat which otherwise would have been radiated and carried away by convection from the ends of the plates, because the products of combustion will leave the chimney at a higher temperature than they would otherwise.

Second method. An artificial draught should be employed for the furnace. It is well known that an artificial draught can be maintained much more economically than can a natural draught in the furnaces of steam boilers. When we use a chimney, a high temperature in the escaping gases is necessary, for otherwise there would be little or no draught. But when we use a blower to force air into the furnace, the products of combustion can be made to leave the chimney, if required, at a temperature but little higher than that of the atmosphere. Hence, the heat from the products of combustion may be caused to elevate the temperature of the inner junctions of a thermo-electric battery, row after row, each row receiving heat from the gases at a lower temperature than the preceding row. The first row with this method would naturally receive heat at the inner junctions, but this temperature would be too high for the metal to endure without either fusion or rapid oxidation. In order to overcome this difficulty, the writer proposes to force air into the thermo-electric battery beyond the furnace, and so as to mingle with the gases of very high temperature which have proceeded from the furnace. By this plan we shall have a large volume of air and mixed gases which are the products of combustion at a temperature which will not be too high for the inner junctions of the thermo-electric battery to endure. A great many elements will be needed to absorb the heat from the large volume of mixed gases. The temperature of the last set of elements at their outer ends should preferably not greatly exceed the temperature of the atmosphere.

Third method. It is well known that the range of temperature for ordinary elements in thermo-electric batteries is only about 90 degrees. There is no advantage in having the heated ends more than 90 degrees hotter than the cooler ends. Now, this being the case, I propose to use the outer ends of the first set of elements as a source of heat for another or second set of elements, the ends of which are nearly in contact therewith, then the outer ends of this second set for a source of heat for the inner or hotter ends of another set, and so on until the inner end of the last set has a temperature of about 90 degrees above that of the atmosphere. Thus I might have about 10 sets of elements, the outer end of each serving as a source of heat for the next set.

Because of the use of artificial draught which forces the products of combustion out of the chimney at a temperature of only about 100 degrees above that of the atmosphere, the waste of heat at the chimney is made much less than usual. Of course, power is required in order to cause artificial draught, but after deducting for this, the efficiency of the thermo-electric battery may be three per cent. Now, if we use, say, 10 sets of elements in order to extract nearly all the heat that would have been wasted, shall we not have secured a very economical thermo-electric generator? Should not the percentage of efficiency prove to be higher than that of any heat engine hitherto constructed? A portion of the heat which enters each set of elements is transformed into electricity, therefore as heat it disappears.

It is extremely probable that in a thermo-electric battery constructed so that the heat is largely utilized, the second law of thermo-dynamics would approximately hold. Suppose we maintain the inner junctions of the inner or first set of elements at a temperature of 960 degrees Fahrenheit, and the outer ends of the last set at a temperature of 150 degrees. If, as is extremely probable, the second law of thermo-dynamics holds good here, we should have a theoretical efficiency of

$$\frac{(960°+460°)-(150°+460°)}{960°+460°}$$

or 57 per cent. This is a much greater efficiency than has ever been obtained from any steam or gas engine. Indeed, it is highly probable that the second law of thermo-dynamics holds good in all thermo-electric batteries when we taken into consideration the heat which is actually transformed into electricity.

Here, then, are several methods proposed for economizing heat in the thermo-electric battery. All these methods may be combined, if desirable; then we shall obtain the highest efficiency. It will probably remain impracticable for some time to use temperatures much higher than 1,000 degrees by Fahrenheit's thermometer, or to use lower temperatures than about 90 degrees above that of the atmosphere which, in the calculation above, was supposed to have a temperature of 60 degrees by Fahrenheit's thermometer.

James Asher.

New York, August 3.

Electrical Resistance.

The assertion that an electric arc can not have negative resistance is now followed by the doubt, expressed by Mr. Rollo Appleyard in an article this week, whether the arc can be said to possess in any circumstances any true resistance whatever. This piece of scepticism makes great demands upon our mental machinery if we wish to comprehend exactly what it means. That specific resistance should apparently become zero, or even negative, under peculiar conditions, we might credit, but that in an electric arc, with its complicated column of heated vapor, it is necessarily always zero, is by no means easy to understand. But, according to Mr. Appleyard's way of regarding the phenomena of the arc, the very attribute of electrical resistance, is inapplicable and what appears to be resistance—whether positive or negative—is really an unknown something else. We can not think that Mr. Appleyard's view is correct, or even that it tends to elucidate matters, yet may the gods forbid us to say that he is wrong, considering what seems to be conceivable in regard to the electric arc. At any rate, the possibility of so extraordinary a conception leads us to press for a definite answer to the question: What is electrical resistance? —*London Electrician.*

To satisfy a judgment of $2,810, Frederick W. Dunton's mile-and-a-half experimental Boynton bicycle road, which was built at a cost of about $30,000, including power house and plant, was sold under foreclosure proceedings on July 29, by Referee William G. Nicoll, and was bought in by W. H. Boynton for $500. The Long Island Boynton Bicycle Railroad Company, the New York and Suburban Investment Company and the Bellport Construction Company were named as defendants in the proceedings.

DO NOT BE AFRAID.

WHEN RIDING ON THE ELECTRIC CARS AND THE FUSE BLOWS OUT—KEEP QUIET.

From the office of the Wire Department of Boston the following statement has been given out:

"In view of the large number of accidents that have occurred in this and other cities and towns throughout the country, due to the use of electricity as a motive power on street railways, and the panics which ensue among passengers when certain things take place that are inevitable and others that are not, the Wire Department deems it advisable to issue the following statement for the benefit of the great number of people who ride on the street cars:

"There are four things that are sure to occur to the electrical equipment of a street railway with a certain degree of regularity: The melting of fuse metals; burning out of motors; burning of the insulation of wires under the floors or on the roofs of cars, or breaking and melting of trolley wires. All these when they have occurred in the past have often caused a needless panic, resulting in serious injury to some of the passengers.

"The fuse metal would not perform its proper function if it did not melt at the proper time and thus prevent a burning out of the motor. They often melt without any noticeable effect, but there are times when they vaporize with a vivid flash and loud report that is somewhat startling; but no injury can occur to the passengers on the car from the 'blowing' of a fuse if they will remain quietly in their places.

"As yet there is no means of effectually preventing the burning out of electric motors, which will occur at times on the best regulated street railroads. When this happens it will not cause the slightest injury to passengers who still remain quietly on the car until it stops.

"The effect produced may be somewhat startling at times to the great majority of people who ride on the cars and prompt them to seek safety in precipitate flight from seeming danger; this has often resulted in personal injury to those who do so without stopping to think of the consequences.

"All grades of insulated covering now used for electrical conductors are perishable, and its failure at times is to be expected. Nearly all the materials used for this purpose are inflammable. For various reasons not necessary to enumerate, the covering on the electric wires in street cars take fire and burn, but not rapidly, and as a rule the other portions of the car are seldom damaged. Here, again, there is no danger to the people on the car if they wait until it stops, when they will have ample time to leave it quietly.

"The trolley wires will and do break at times, but in doing so they will not injure those persons who remain in their seats. If it is necessary to leave the car, do it leisurely and quietly and avoid the broken ends of the trolley wire; it will not injure any one who does not touch it. While it may give marked evidence of the energy it transmits when in contact with the wet ground or some other good conductor, it will not harm the passerby who avoids it. Let all remember that this (to them) mysterious power is controllable, even though it does kick over the traces at times."

Welleville, Ohio, is in darkness, as the city council and local electric light company can not agree on the price to be charged for lights.

The Quimby Electric Pumps.

The newly perfected Quimby rotary pumps for direct-connected electric work embody certain features which show an advance in this line of electric machinery, the general form and construction of which is shown in the accompanying illustrations.

The four screws which act as pistons in propelling water are mounted in pairs on parallel shafts, so arranged that in each pair the thread of one screw projects to the bottom of the space between the threads of the opposite screws. The pump cylinder fits the perimeters of the threads, as shown in Fig. 2.

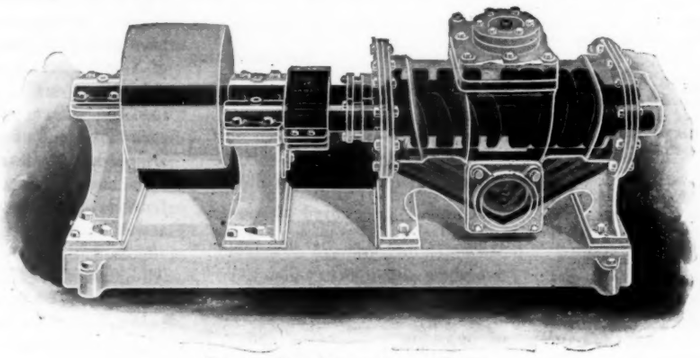

FIG. 1.—THE QUIMBY SCREW PUMP.

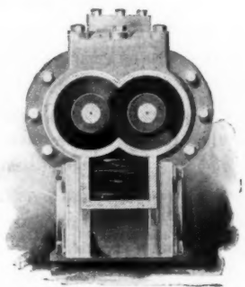

FIG. 2.—CYLINDER OF QUIMBY PUMP.

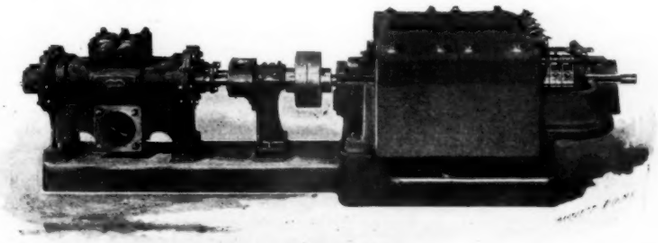

FIG. 3.—QUIMBY DIRECT CONNECTED ELECTRIC PUMP

The pump and motor are mounted on the same bed-plate, and the motor shaft is coupled directly to one of the pump shafts, as shown in Fig. 3. Coupled in this way the number of moving parts is minimized.

The Quimby electric house pump, illustrated in Fig. 4, is constructed primarily to operate noiselessly, and to avoid noise in the delivery pipes.

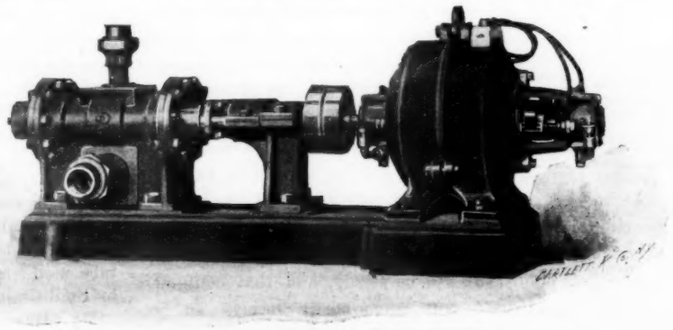

FIG. 4.—QUIMBY ELECTRIC PUMP FOR HOUSE SERVICE.

This pump is extremely simple in operation, being self-lubricating, and the motor is provided with large oil cups, so that under ordinary service the pump would not require any attention oftener than once in two weeks. The operating screws in this pump are made of brass, so that the pump can be left standing for a considerable time without becoming clogged by rust.

These machines are manufactured by William E. Quimby, at Boston, with a New York office at 59 Liberty street.

Cahn's Theatrical Guide.

The ELECTRICAL REVIEW has received, with the compliments of the publisher, Julius Cahn, of New York, his official theatrical guide. The book is a volume of about 600 pages and is a very comprehensive and exhaustive production. It gives the name of every theater in the United States and a complete list of officers, including electricians. This is the first issue. The second will be published June 1, 1897. The book is nicely bound in blue cloth and will prove an addition to every theatrical library in the country.

Everybody Should Understand the Meaning of "16 to 1."

TO THE EDITOR OF ELECTRICAL REVIEW:

One silver dollar.	One gold dollar.
Weighs 412.50 grains.	25.8 grains.
	(412.50 ÷ 25.8 = 15.976, 16 to 1.)
Arbitrary coinage value of silver, $1.29 per ounce.	Gold, $20.67 per ounce.
Actual value by weight of silver, 65 cents per ounce.	Gold, $20.67 per ounce.
Actual value of $1 coin of silver, 50 cents.	Gold, $1.

A gold coin, fresh from the mint, hammered flat or cut into pieces, is actually worth its face value by weight, the world over.

When the United States silver coins were legalized, silver had a market value of $1.29 per ounce. Since that time the remarkable development of the silver mining and smelting industry has enabled mine owners to produce silver, in immense quantities, for 65 cents per ounce, and make a large profit at that price. They are now asking the government to coin all the silver they can bring to its mints. This plan to double the wealth of a small class of people all "Silverites" are expected to support.

G. C. M.

Washington, D. C., Aug. 1, 1896.

The government of Costa Rica has established a consulate in Philadelphia, and has appointed Mr. Gustavo Niederlein, 233 South Fourth street, as consul. Mr. Niederlein requests that manufacturers send to him two copies of all their catalogues in English and one copy in Spanish, if they publish any in that language. Mr. Niederlein is a man of international experience, and proposes to make every effort to increase the export and import trade between the United States and Costa Rica.

ELECTRICAL REVIEW

Times Building, 41 Park Row,
P. O. Box 2339. NEW YORK.

EDITOR:
CHARLES W. PRICE.

ASSOCIATE EDITOR:
STEPHEN L. COLES.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

1546 "CORTLANDT," TELEPHONE CALL.

SUBSCRIPTION TO THE
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy, - - - - - - - .10

Copies can only be supplied for one year back at 25 cents each.

SPECIAL NOTICE TO ADVERTISERS.

***CHANGES** for advertisements must be in this office by Friday noon for the following week's issue.*

***NEW ADVERTISEMENTS** should be in the office not later than Saturday noon to insure publication the following week.*

NEW YORK, AUG. 12, 1896.

CONTENTS.

	PAGE.
Views, News and Interviews	73
Edwards's New Induction Coil	73
A New Illuminant	73
The Insurance of Electrical Plants	74
Boston Electric Light Company's Annual Report	75
Personal	75
Wall Street and McKinley	75
The Electrical Stock Market	75
Electrical Yachtsmen	75
Improvements in Thermo-Electric Batteries	76
Electrical Resistance	76
Do Not Be Afraid	77
The Quimby Electric Pumps	77
Cahn's Theatrical Guide	77
Everybody Should Understand the Meaning of "16 to 1"	77
Tesla on the Nature of the Roentgen Rays	78
To Stop Cutting Prices	78
Deleterious Effects of X Rays on the Human Body	78
Roentgen Rays or Streams	79
A New "Lightning Express" Under Railway System	80
Literary	80
Obituary	80
Association of Edison Illuminating Companies	80
National Electric Light Association	81
The Growth of the New York Telephone System	81
True Resistance	81
On Hyperphosphorescence	82
Assignment of H. E. & C. Baxter	82
Manufacturing Notes	82
Police and Fire Telegraph Superintendents	83
Electric Railway Notes	83
Kind Words	83
Advance Information	84
Kindred Interests	ix
Electrical Patents	x
Trade Notes	x
Kind Words	x

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE
Abendroth & Root Mfg. Co., boilers	xvi
American Electrical Works, insulated wire	i
Armington & Sims, engines	xvi
Babcock & Wilcox Co., boilers	xvi
Beacon Lamp Co., incandescent lamps	i
Biddle, Jas. G., testing instruments	i
Brill, J. G., Co	ii
Bristol Co., recording voltmeters, etc	i
Brush Electric Co	ii
Bunnell & Co., J. H., dry batteries	i
Day's Kerite, insulated wire	i, viii
Electric Appliance Co., supplies	i
Greeley, The E. S., & Co., electrical supplies	i
Hampson, E. P., & Co., engines	xvi
Interior Conduit and Insulation Co., Lundell dynamos and motors	i
Lombard Water Wheel Governor Co	xvi
New York Insulated Wire Co., Grimshaw wires and cables	i
Okonite Co., insulated wire	i, xvi
Partridge Carbon Co., motor and generator brushes	i
Roebling's, John A., Sons Co., lead-encased cables	xvi
Safety Insulated Wire and Cable Co	i
Splitdorf, C. F., induction coils	i
Standard Paint Co., insulating compound	i
Standard Underground Cable Co	xvi
Sterling Supply & Mfg. Co	ii
Stirling Co., water tube boilers	xvi

INSIDE PAGES.

Addystone Pipe and Steel Co	vi
American Bell Telephone Co	xiii
American Electric Telephone Co., long-distance telephones	xiii
American Engine Co., American-Ball engines	vi
Baechtold & Parker Electric Co., American arc dynamos	ix
Baker & Co., platinum	iii
Ball & Wood Co., engines	vi
Boettcher, C	x
Brady, T. H., Brady mast-arms	vi
Brixey, W. R., Day's kerite wires and cables	viii
Buckeye Electric Co	vii
Central Electric Co., fans	iii
Central Islip Improvement Co	ix
Chase & Vale, patent attorneys	x
Connecticut Pipe Mfg. Co	xi
Connecticut Telephone and Electric Co	xii
Consolidated Telegraph and News Co	xii
Cutter Electric and Mfg Co	ix
C. & C. Electric Co	viii
Diehl Electric Co	iv
Dixon, Jos., Crucible Co., belt dressing	iii
Duval, E. S., Jr., patents	x
Dyer & Driscoll, patent solicitors	x
Edison Decorative & Miniature Lamp Department, X-ray apparatus	ix
Edison Mfg. Co	iii
Electric Storage Battery Co	vii
Empire China Works, porcelain specialties	x
Eppenger & Russell Co., Valentine subway electrical conduit	xi
Faraday Carbon Co., carbons	vi
Farr Telephone Construction & Supply Co	xiii
Forest City Electric Works	xii
Fort Wayne Electric Corporation	x
Garvin Machine Co	vi
Gordon-Burnham Battery Co	x
Hano, Philip, & Co	xii
Hoopes & Townsend	vi
Hooven, Owens & Rentschler Co., electric railway and electric light engines	iii
Huebel & Manger, bells, push buttons, etc	ix
India Rubber and Gutta Percha Insulating Co	viii
International Correspondence Schools	ix
Jewell Belting Co	xi
Keystone Telephone Co	xiii
Leffel, Jas., & Co., water wheels	viii
Lehigh Valley Creosoting Co., creosoted lumber	vi
Manhattan Electrical Supply Co	xii
Marshall, Wm., condensers	ix
Mason-Maxwell Telephone Mfg. Co	xii
McIntire, C., Co., The, connectors and terminals	ix
Menlo Park Mfg. Co	ix
Mianus Electric Co., telephones and electric supplies	xii
Michigan Electric Co	viii
Moore, Alfred F., insulated electric wire	ix
Morrison Southern Electric Co	xiv
Morris, Tasker & Co	v
National Pipe Bending Co	iv
New England Engineering Co	x
New York Telephone Co	ix
Novelty Electric Co., supplies	iii
Ostrander, W. R., & Co., supplies	vi
Pettingell-Andrews Co	iii
Phillips Insulated Wire Co., wire	vi-i
Replogle Governor Works	xi
Rodrigues, M. R	x
Rose Polytechnic Institute	ix
Royce & Marean, electrical supplies	xi
Rushmore Dynamo Works	vi-i
Safety Car Heating and Lighting Co	iv
Siemans & Halske Electric Co. of America	vii
Solar Carbon and Manufac uring Co	xi
Stanley Electric & Mfg. Co	v
Thayer & Co., inc	vii
U. S. Mineral Wool Co	v, vi
Utica Electrical Mfg. & Supply Co	ix
Viaduct Mfg. Co., telephones, etc	xiii
Wanted	iii, ix
Warren, A. K., & Co	ix
Washington Patent Agency	x
Western Electric Co., fans	xiv
Western Telephone Construction Co	xii
Westinghouse Electric & Mfg. Co	xiv
Weston Electrical Instrument Co., measuring instruments	viii
White-Crosby Co., contracting engineers	ix
Whitney Electrical Instrument Co	ix
Williams, J. P	ix

An interesting communication from Mr. James Asher on improvements in thermo-electric batteries is published in this issue of the ELECTRICAL REVIEW. In spite of the fact that the most efficient batteries of this kind are said to transform less than one per cent of the heat expended into electrical energy, the problem of getting electricity direct from heat is the most fascinating one with which the electrical inventor has to deal.

TESLA ON THE NATURE OF THE ROENTGEN RAYS.

In our present issue we publish another important communication from Mr. Tesla in regard to the Roentgen rays. Mr. Tesla has worked ceaselessly, and in his articles, exclusively published in our columns, he has made most valuable contributions to the knowledge of this fascinating subject. His opinions carry the greater weight as they are supported by a mass of experimental evidence, and as his insight into many phenomena has proved to be true. What services has he not rendered to science and industry merely by his demonstrations of the action of air or gases in condensers and high-tension transformers! His present contribution is, in part, a summing up of the observations already made by him, and is particularly important in this, that it substantiates the ideas originally expressed by Professor Roentgen.

Mr. Tesla brings forward many convincing arguments to show that these rays consist of streams of matter in some primary condition, which is, to a certain extent, equivalent to saying that they are streams of ether into which the matter is dissolved by the violent impact.

There is thus opened up a wonderful possibility of transformation of matter into its primary constituents, never before contemplated or thought possible, and it is safe to say that a more absorbing subject for study and investigation could not be found in physical science.

TO STOP CUTTING PRICES.

The incandescent lamp manufacturers, after two or three years of cutting of prices, have concluded that it would be better to maintain a regular price for standard lamps hereafter, and let the customer choose his lamp for its quality and not on account of cheapness or amount of rebate. A number of manufacturers have been discussing this question for several weeks, and an agreement has been reached. This does not take the form of a trust or combination, but means, if lived up to, that prices of lamps will be steady, and that consumers will undoubtedly receive an improved article. The larger companies, like the General Electric Company and the Westinghouse Company, apparently think the agreement a good thing, and the immense number of users of the incandescent lamp hope to find that they are to be benefited as well.

DELETERIOUS EFFECTS OF X RAYS ON THE HUMAN BODY.

It seems that the wonderful effects of X rays have not all been learned. One of the newest of these takes the form of a physical effect upon the person who uses powerful X-ray apparatus for comparatively long periods at a time. Mr. H. D. Hawks, a graduate in the class of 1896, of Columbia College, has for the past few weeks been giving exhibitions in the vicinity of New York with an unusually powerful X-ray outfit. Mr. Hawks, during the afternoon and evening of each day for four days, was working around his apparatus for from two to three hours at a time. At the end of four days he was compelled to cease active work, owing to the physical effects of the X rays upon his body. The first thing Mr. Hawks noticed was a drying of the skin, to which he paid no attention, but after awhile it became so painful it was necessary to stop all operations. The hands began to swell and assumed the appearance of having a very deep sunburn. At the end of two weeks the skin all came off the hands. The knuckles were especially affected, they being the sorest part of the hand. Among other effects were the following: The growth of the finger nails was stopped and the hair on the skin that was exposed to the rays all dropped out, especially on the face and sides of the head. The hair at the temples has entirely disappeared, owing to the fact of Mr. Hawks having placed his head in close proximity to the tube to enable spectators to see the bones of the jaw. The eyes were quite bloodshot and the vision was considerably impaired. The eyelashes began to fall out and the lids to swell. The chest was also burned through the clothing, the burn resembling sunburn. Mr. Hawks's disabilities were such that he was compelled to suspend work for two weeks. He consulted physicians, who treated the case as one of parboiling.

To overcome these effects of the X rays, Mr. Hawks first tried covering his hand with vaseline and then putting a glove on, but the hand was at once burned again, the glove affording no protection whatever. The hand was finally protected by covering it with tin foil. Mr. Hawks coincides with Tesla's belief that X rays are practically minute material particles thrown off from the walls of the tube. The apparatus used was a 10-inch induction coil, manufactured by Ritchie & Son, of Brookline, Mass. The primary circuit was opened and closed by means of a rotary brake mounted on the shaft of a motor, there being 120 breaks a second. The tube used was a focusing tube, made by Emil Greiner, of New York.

Mr. Hawks has made a careful study of his case and has reached the conclusion that no other cause than his exposure to the X rays is responsible for his condition. His personal appearance certainly bears out his statement. The ELECTRICAL REVIEW will be glad to hear from any of its readers who have experienced similar effects, even in a lesser degree.

Roentgen Rays or Streams.

To the Editor of the Electrical Review:

In the original report of his epochal discoveries, Roentgen expressed his conviction that the phenomena he observed were due to certain novel disturbances in the ether. This opinion deserves to be considered the more as it was probably formed in the first enthusiasm over the revelations, when the mind of the discoverer was capable of a much deeper insight into the nature of things.

It was known since long ago that certain dark radiations, capable of penetrating opaque bodies, existed, and when the rectilinear propagation, the action on a fluorescent screen and on a sensitive film was noted, an obvious and unavoidable inference was that the new radiations were transverse vibrations, similar to those known as light. On the other hand, it was difficult to resist certain arguments in favor of the less popular theory of material particles, especially as, since the researches of Lennard, it has become very probable that material streams, resembling the cathodic, existed in free air. Furthermore, I myself have brought to notice the fact that similar material streams—which were subsequently, upon Roentgen's announcement, found capable of producing impressions on a sensitive film—were obtainable in free air, even without the employment of a vacuum bulb, simply by the use of very high potentials, suitable for imparting to the molecules of the air or other particles a sufficiently high velocity. In reality, such puffs or jets of particles are formed in the vicinity of every highly charged conductor, the potential of which is rapidly varying, and I have shown that, unless they are prevented, they are fatal to every condenser or high-potential transformer, no matter how thick the insulation. They also render practically valueless any estimate of the period of vibration of an electro-magnetic system by the usual mode of calculation or measurement in a static condition in all cases in which the potential is very high and the frequency excessive.

It is significant that, with these and other facts before him, Roentgen inclined to the conviction that the rays he discovered were longitudinal waves of ether.

After a long and careful investigation, with apparatus excellently suited for the purpose, capable of producing impressions at great distances, and after examining the results pointed out by other experimenters, I have come to the conclusion which I have already intimated in my former contributions to your esteemed journal, and which I now find courage to pronounce without hesitation, that the original hypothesis of Roentgen will be confirmed in two particulars: first, in regard to the longitudinal character of the disturbances; second, in regard to the medium concerned in their propagation. The present expression of my views is made solely for the purpose of preserving a faithful record of what, to my mind, appears to be the true interpretation of these new and important manifestations of energy.

Recent observations of some dark radiations from novel sources by Becquerel and others, and certain deductions of Helmholtz, seemingly applicable to the explanation of the peculiarities of the Roentgen rays, have given additional weight to the arguments on behalf of the theory of transverse vibrations, and accordingly this interpretation of the phenomena is held in favor. But this view is still of a purely speculative character, being, as it is at present, unsupported by any conclusive experiment. Contrarily, there is considerable experimental evidence that some matter is projected with great velocity from the bulbs, this matter being in all probability the only cause of the actions discovered by Roentgen.

There is but little doubt at present that a cathodic stream within a bulb is composed of small particles of matter, thrown off with great velocity from the electrode. The velocity probably attained is estimable, and fully accountable for the mechanical and heating effects produced by the impact against the wall or obstacle within the bulb. It is, furthermore, an accepted view that the projected lumps of matter act as inelastic bodies, similarly to ever so many small lead bullets. It can be easily shown that the velocity of the stream may be as much as 100 kilometers a second, or even more, at least in bulbs with a single electrode, in which the practicable vacua and potentials are much higher than in the ordinary bulbs with two electrodes. But, now, matter moving with such great velocity must surely penetrate great thicknesses of the obstruction in its path, if the laws of mechanical impact are at all applicable to a cathodic stream. I have presently so much familiarized myself with this view that, if I had no experimental evidence, I would not question the fact that some matter is projected through the thin wall of a vacuum tube. The exit from the latter is, however, the more likely to occur, as the lumps of matter must be shattered into still much smaller particles by the impact. From my experiments on reflection of the Roentgen rays, before reported, which, with powerful radiations, may be shown to exist under all angles of incidence, it appears that the lumps or molecules are indeed shattered into fragments or constituents so small as to make them lose entirely some physical properties possessed before the impact. Thus, the material composing the electrode, the wall of the bulb or obstruction of any kind placed within the latter, are of absolutely no consequence, except in so far as the intensity of the radiations is concerned. It also appears, as I have pointed out, that no further disintegration of the lumps is attendant upon a second impact. The matter composing the cathodic stream is, to all evidence, reduced to matter of some primary form, heretofore not known, as such velocities and such violent impacts have probably never been studied or even attained before these extraordinary manifestations were observed. Is it not possible that the very ether vortexes which, according to Lord Kelvin's ideal theory, compose the lumps, are dissolved, and that in the Roentgen phenomena we may witness a transformation of ordinary matter into ether? It is in this sense that, I think, Roentgen's first hypothesis will be confirmed. In such case there can be, of course, no question of waves other than the longitudinal assumed by him, only, in my opinion, the frequency must be very small—that of the electro-magnetic vibrating system—generally not more than a few millions a second. If such process of transformation does take place, it will be difficult, if not impossible, to determine the amount of energy represented in the radiations, and the statement that this amount is very small should be received with some caution.

As to the rays exhaustively studied by Lennard, which have proved to be the nucleus of these great realizations, I hold them to be true cathodic streams, projected through the wall of the tube. Their deflectibility by a magnet shows to my mind simply that they differ but little from those within the bulb. The lumps of matter are probably large and the velocity small as compared with that of the Roentgen rays. They should, however be capable in a minor degree of all the actions of the latter. These actions I consider to be purely mechanical and obtainable by other means. So, for instance, I think that if a gun loaded with mercury were fired through a thin board, the projected mercury vapor would cast a shadow of an object upon a film made especially sensitive to mechanical impact, or upon a screen of material capable of being rendered fluorescent by such impact.

The following observations made by myself and others speak more or less for the existence of the streams of matter.

I—PHENOMENA OF EXHAUSTION.

On this subject I have expressed myself on another occasion. It is only necessary to once more point out that the effect observed by me should not be confounded with that noted by Spottiswoode and Crookes. I explain the latter phenomenon as follows: The first fluorescence appearing when the current is turned on, is due to some organic matter almost always introduced in the bulb in the process of manufacture. A minute layer of such matter on the wall produces invariably this first fluorescence, and the latter never takes place when the bulb has been exhausted under application of a high degree of heat or when the organic matter is otherwise destroyed. Upon the disappearance of the first fluorescence the rarefaction increases slowly, this being a necessary result of particles being projected from the electrode and fastening themselves upon the wall. These particles absorb a large portion of the residual gas. The latter can be again freed by the application of heat to the bulb or otherwise. So much of the effects observed by these investigators. In the instance observed by myself, there must be actual expulsion of matter, and for this speak following facts: (a) the exhaustion is quicker when the glass is thin; (b) when the potential is higher; (c) when the discharges are more sudden; (d) when there is no obstruction within the bulb; (e) the exhaustion takes place quickest with an aluminum or platinum electrode, the former metal giving particles moving with greatest velocity, the latter particles of greatest weight; (f) the glass wall, when softened by the heat, does not collapse, but bulges outwardly; (g) the exhaustion takes place, in some cases, even if a small perceptible hole is pierced through the glass; (h) all causes tending to impart a greater velocity to the particles hasten the process of exhaustion.

II—RELATION BETWEEN OPACITY AND DENSITY.

The important fact pointed out early by Roentgen and confirmed by subsequent research, namely, that a body is the more opaque to the rays the denser it is, can not be explained as satisfactorily under any other assumption as that of the rays being streams of matter, in which case such simple relation between opacity and density would necessarily exist. This relation is the more important in its bearing upon the nature of the rays, as it does not at all exist in light-giving vibrations, and should consequently not be found to so marked a degree and under *all conditions with vibrations*, presumably similar to and approximating in frequency the light vibrations.

III—DEFINITION OF SHADOWS ON SCREEN OR PLATE.

When taking impressions or observing shadows while varying the intensity of the radiations, but maintaining all other conditions as nearly as possible alike, it is found that the employment of more intense radiations secures little, if any, advantage, as regards the definition of the details. At first it was thought that all there was needed was to produce very powerful rays. But the experience was disappointing, for, while I succeeded in producing rays capable of impressing a plate at distances of certainly not less than 30 metres, I obtained but slightly better results. There was one advantage in using such intense rays, and this was that the plate could be further removed from the source, and consequently a better shadow was obtained. But otherwise nothing to speak of was gained. The screen in the dark box would be at times rendered so bright as to allow reading at some distance plainly, but the shadow was not more distinct for all that. In fact, often a very strong radiation gave a poorer impression than a weak one. Now, a fact which I have repeatedly observed and to which I attach great importance in this connection, is the following: When taking impressions at a small distance with a tube giving very intense rays, no shadow, unless a scarcely perceptible one, is obtained. Thus, for instance, the flesh and bones of the hand appear equally transparent. Increasing presently gradually the distance, it is found that the bones cast a shadow, while the flesh leaves no impression. The distance still increased, the shadow of the flesh appears, while that of the bones grows deeper, and in this neighborhood a place can be found at which the definition of the shadow is clearest. If the distance is still further continually increased, the detail is lost, and finally only a vague shadow is perceptible, showing apparently the outlines of the hand.

This often-noted fact disagrees entirely with any theory of transverse vibrations, but can be easily explained on the assumption of material streams. When the hand is near and the velocity of the stream of particles very great, both bone and flesh are easily penetrated, and the effect due to the difference in the retardation of the particles passing through the heterogeneous parts can not be observed. The screen can fluoresce only up to a certain limited intensity, and the film can be affected only to a certain small degree. When the distance is increased, or, what is equivalent, when the intensity of the radiation is reduced, the more resisting bones begin to throw the shadow first. Upon a further increase of the distance the flesh begins likewise to stop enough of the particles to leave a trace on the screen. But in all cases, at a certain distance, manifestly that which under the conditions of the experiment gives the greatest difference in the trajectories of the particles within *the range perceptible on the screen or film*, the clearest shadow is secured.

IV—THE RAYS ARE ALL OF ONE KIND.

The preceding explains the apparent existence of rays of different kind; that is, of different rates of vibration, as it is asserted. In my opinion, the velocity and possibly the size of the particles both are different, and this fully accounts for the discordant results obtained in regard to the transparency of various bodies to these rays. I found, for example, in many cases that aluminum was less transparent than glass, and in some instances brass appeared to be very transparent as compared with other metallic bodies. Such observations showed that it was necessary, in making the comparison, to take rigorously equal thicknesses of the bodies and

(Concluded on page 83.)

A New "Lightning Express" Electric Railway System.

A few days ago, in response to an invitation from Mr. R. Chipperfield, I went to his workshop in Great Windmill street to see a working model he had constructed of Mr. F. B. Behr's Lightning Express Railway. Mr. Behr himself was present to explain the construction of the railway, and the hopes he had of its ultimate success, and I confess that the personality of the enthusiastic inventor interested me even more than his invention.

The model departed in some respects from the plan of the railway itself, which is to be tried next year on a comparatively large scale near Brussels. The exigencies of space necessitated relatively sharper curves in the model line, and the cars had to be modified accordingly, leaving far less room in proportion for the motors. The current, too, was taken from the rail itself, whereas on the actual line it will be taken from a special conductor; and the lamps had to be lighted by the same current, so that they flashed up and down very irregularly as the contact with the rail varied or perhaps with the demand of the motor. Still, with all disadvantages the model worked; there was a good deal of sparking at the commutator, a loose wheel gave trouble, and some loose contacts gave rise to a shower of sparks; but these were difficulties due to hasty work and to the small scale on which the thing was constructed; and if there was more noise than might have been expected, that was accounted for by the fact that the line was practically laid on a sounding board, so that all sound was magnified.

I was somewhat astonished, on trying to move the cars by hand, to find how great was the resistance to motion. This I am inclined to put down chiefly to the friction of the guide rails and wheels, which in actual work will be relatively very much smaller. Mr. Behr has increased the number of these guide rails to four, and it certainly seems impossible that his cars should be derailed by anything short of a total wreck of the permanent way. I found it, however, difficult to understand why Mr. Behr insists on omitting the obvious precaution of tilting his rails at a curve. He was at some pains to prove that the strain would not come on the guide rails, but on the central rail, but he did not convince me that it was so. If I had been able to accept his reasoning, the conclusion I should have drawn would have been that most mischievous strains would be thrown on the rims and bearings of the wheels, as well as on the bolts holding the center rail in position—strains which would almost certainly lead to disaster. As, however, I feel sure that the thrust outward in going round a curve will come mainly on the guide rails, I do not anticipate any serious difficulty from this cause.

It is quite impossible to judge from the working of a model whether Mr. Behr's ambitious scheme is practicable or no, and I shall wait to see the result of the Brussels experiment. But I hope Mr. Behr will reconsider the laying of his line at the curves. Theory and experience are both against him in this matter, and though by the strength of his materials he should avoid a wreck, it is not well to subject line and car to unnecessary strains, especially as he acknowledges that the remedy is easily accomplished. Moreover, though he may by sheer force keep his *car* upright, the tendency will be to throw its contents, passengers included, against the plate-glass windows on the outer side of the car, the more so as the seats are arranged lengthways, so that half the passengers face each window. However, Mr. Behr has had many years' experience of the Lartigue single-rail system in Ireland, and he has given more than three years to the working out of his present proposal, so that any criticism of it must needs be made with a certain diffidence. I have never thought his idea quite impracticable, even when he talks of 150 miles an hour. Whether it would pay is another question, as also whether cars could be safely run at that speed at intervals of only five or ten minutes.—*London Lightning.*

LITERARY.

We acknowledge the receipt of the "Bulletin of the Electro-Therapeutical Laboratory of the University of Michigan," for July, devoted chiefly to a discussion of X-ray phenomena.

The Kansas Academy of Science, by Mr. B. B. Smyth, Topeka, Kas., has sent the ELECTRICAL REVIEW the "Transactions" of the 26th and 27th annual meetings of the Academy. The work is a very interesting one, containing much valuable information which is compactly presented and well edited by Mr. Smyth.

Along with the great mass of political literature which has been published even thus early in the presidential campaign, is the sketch of "McKinley and Hobart," by Byron Andrews. As a Washington correspondent and life-long journalist, Mr. Andrews is peculiarly well fitted to prepare biographies, and because of his forceful style the volume will become a standard addition to America's historical and political literature.

Published by F. Tennyson Neely, 114 Fifth Avenue, New York.

The new volume, "Good Advertising," just compiled and written by the advertising expert, Charles Austin Bates, is an epitome of the question of advertising relative to methods, ideas and results prepared in such a manner that any business man who advertises, even to a very limited extent, may gain practical information based on the actual experience of others. The author does not present the book as a literary effort, but as a collection of a mass of facts and information which might be in the nature of a text-book of a subject, the importance of which is so great that the acquisition of one useful hint repays an advertiser for the perusal.

The volume is published by the Holmes Publishing Company, at $5, 15-17 Beekman street, New York.

The August number of *The Home Magazine*, of Binghamton, opens with a thrillingly interesting account of the life and adventures of Captain Paul Boyton, who is appropriately called the "man-fish." Accompanying the article is a series of photographs, now published for the first time, showing Captain Boyton at various stages of his life, beginning with a view taken at the age of 10. The incident of his landing on the Irish coast, in his novel swimming suit, on his first trial trip, and how he overcame the objections of those who thought he was bent on suicide, will be found among the best things in the entertaining article. A characteristic and very readable description of the English Channel Islands, is from the pen of the late Violet Etynge Mitchell. "Drunkenness as a Disease," by Thomas E. Barry, will be read with deep interest by every student of the reform movements of the day. It presents in a vivid manner the newest temperance reform. A dozen engravings, including a portrait of Dr. Keeley, accompany the article. Among the many other attractive features of this number may be mentioned: "The Stars on the Field of 'Old Glory'," by J. F. Earhart; "A New Plan for International Waterways," by J. A. C. Wright; "The Mind Children," by J. F. Leon Mead; and two short stories by Max Nordau, the celebrated author of "Degeneration." Every dollar of profit realized from the publication of this magazine goes toward building the national home for commercial travelers at Binghamton, N. Y.

OBITUARY.

The Right Hon. Sir William Robert Grove, D. C. L., LL. D., P. C., F. R. S., died in London August 2, 1896. Sir William was born July 11, 1811, and was educated at Oxford. He was called to the bar at Lincoln's Inn. Being temporarily prevented by ill-health from following the legal profession, he began the study of electricity, and in 1839 constructed the powerful voltaic battery which bears his name. He was professor of experimental philosophy at the London Institution from 1840 to 1847, and took an active part in reforming the constitution of the Royal Society. He was president of the British Association at Nottingham in 1866, when he selected for the subject of his address, "The Continuity of Natural Phenomena."

The honor of knighthood was conferred upon him February 21, 1872. He made several important discoveries in electricity and optics. He was the author of a remarkable lecture, delivered in January, 1842, on "The Progress of Physical Science Since the Opening of the London Institution." In this he first announced the doctrine of the mutual convertibility of the various natural forces—heat, electricity, etc.—and of their being all modes of motion or forms of persistent force. He further developed the doctrine in his essay on "The Correlation of the Physical Forces."

Association of Edison Illuminating Companies.

The above association meets this week at the Oriental Hotel, Manhattan Beach, L. I., where its members are sure to be hospitably treated by the proprietor, Mr. T. F. Silleck. The officers of the association are: President, C. L. Edgar, Boston, Mass.; vice-president, Samuel Insull, Chicago, Ill.; secretary, W. S. Barstow, Brooklyn, N. Y.; treasurer, J. W. Lieb, Jr., New York, N. Y. Executive Committee: John I. Beggs, chairman, the Cincinnati Edison Electric Company, 164 West Eighth street, Cincinnati, Ohio; C. P. Gilbert, Detroit, Mich.; E. R. Weeks, Kansas City, Mo.; M. A. Beal, Rockford, Ill.; G. R. Stetson, New Bedford, Mass.; C. L. Edgar (ex-officio), Boston, Mass. The meeting began August 11 and will continue through the 12th and 13th, the latter day being devoted to a trip to Schenectady to visit the extensive works of the General Electric Company.

Secretary Barstow announces that the meetings of the convention promise to be especially interesting. The Executive Committee have had many important meetings during the past year, and will submit suggestions. Besides the reports of the various committees, there will be papers on the selection of alternating-current apparatus for central lighting stations, and the experience of large Edison stations in this direction. The recent developments in the new underground systems and the use of cables as auxiliaries thereto will be exhaustively treated. The actual results obtained from the operation of large storage batteries in New York and Boston will be another subject of importance, as will also the English or Wright-Demand system of charging for current. Besides the topics mentioned above, there will be several other papers which can not fail to interest all Edison licensees.

As, in accordance with a decision of the Executive Committee several years ago, the papers will be published only in the minutes of the association, the secretary urges the attendance of every representative possible, in order that a full discussion may be obtained.

In accordance with the custom of previous conventions, the business sessions will be relieved by entertainments, and provision will be made for the ladies during the time of the meetings. The third day will be devoted entirely to entertainments by the acceptance of the invitation from the General Electric Company to accompany them on a special train to Schenectady and visit their works. Special arrangements have been made on this trip for the ladies of the convention, so that it is expected all will participate. A detail programme of the convention will be furnished the delegates on their arrival at the hotels. Any members desiring to visit the stations of the Edison Electric Illuminating Company of Brooklyn were invited to do so, informally, on Monday, August 10, as the programme of the convention did not admit of a later formal visit.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

PRESIDENT'S INTERIM REPORT.

When elected president of your association, I fully realized that much useful work might be accomplished during the interval between conventions, and have earnestly endeavored since our last annual meeting to initiate and, with the assistance of our secretary, to conclude certain matters which I am hopeful will be approved of by our members, and upon which I now have the honor to report as follows:

Relations between Manufacturing and Central Station Companies—At our last convention the Committee on Relations between Manufacturing and Central Station Companies was discharged, and the Executive Committee authorized to take such action as might, from time to time, be found necessary, in an endeavor to protect its active members from having their investments in central station companies destroyed, or seriously impaired, as a result of ruinous competition, directed or fostered by the manufacturing companies. At an early period of my administration such a case arose, in a western town, as justified prompt and energetic action on the part of your association. After consultation with the members of the Executive Committee, I placed the views of our association as to this particular case, and as to unwise and unwarranted competition in general, before the executive officers of the following manufacturing companies:

Ball Electric Light Company, Brush Electric Company, Fort Wayne Electric Corporation, General Electric Company, Royal Electric Company, of Peoria, Siemens & Halske Electric Company, Stanley Electric Manufacturing Company, Western Electric Company, Westinghouse Electric and Manufacturing Company.

The details of our negotiations, by correspondence and in some cases by personal interview, are too voluminous to here set forth, but it is with much satisfaction that I am able to report that each of these companies, with the exception of the Ball Electric Light Company, has given favorable consideration to the representations made on behalf of your association, and I have received, in writing, such satisfactory assurances regarding not only the particular case in question, but also as to their future general policy, that I am hopeful of good results. Should, however, any active member have reasonable cause for complaint, he should forward full corroborative details to our secretary, and the association will take prompt and energetic measures, if the circumstances warrant such action.

Municipal Lighting Statistics—Being aware that no recent and reliable statistics of the cost of arc lighting in the cities and towns were available for use by members of the association, I some time since instituted correspondence with the municipal authorities of each city and town in the United States, with the object of securing from official sources and by official authority reliable information from each place as to (1) the number of arc lamps, (2) their candle-power, (3) the hours of burning, (4) the cost per lamp per night. Accompanying this report you will receive, in pamphlet form, a preliminary bulletin, containing such information from over 400 cities and towns, which list covers a very large majority of the principal installations. A supplementary list, containing similar information in regard to places now omitted, is in process of compilation, and will be issued to members at an early date. It frequently happens that when a contract is to be renewed, local papers publish very misleading figures concerning prices paid for arc lights in other municipalities, and as these statistics are of the months of June and July, 1896, they are reliable and up to date.

Laws Affecting Electrical Companies—We have been in correspondence with the Secretaries of State for each of the States in the Union, with a view to making arrangements to have regularly forwarded to the association copies of all bills introduced in any State that may deal with the rights of electrical companies. I am much pleased to be able to report that a large majority of the States have acceded to our request, and several have already forwarded copies of all bills passed during the past session of their legislature, while others have promised to forward any that may be introduced during future sessions. These will all be filed in the secretary's office for the sole use and advantage of the members of the association.

Revision of Constitution—As the only printed copies of the constitution and by-laws of the association did not contain recent additions and amendments, revised copies have been published, and may be obtained from the secretary.

Report of Proceedings of Nineteenth Convention—The report of the recent convention, held in this city, is now in the printer's hands, and will be delivered to members not later than September 1, next. There has been some unavoidable delay, caused by speakers at the convention failing to revise the stenographic copy of their remarks, but, so far as my memory serves, it will be issued much in advance of previous reports.

Improved Office Facilities—The office of the association being too small to be of service to our members visiting New York, the chairman of the Finance Committee made arrangements to rent the adjoining office, with the special object of providing a room for the use of our out-of-town members. The office is centrally located in the downtown business district. Members can use this room for meetings, appointments, etc., and their letters and telegrams can be addressed here. As the records of the association are increasing in number, two new bookcases have been provided, and already contain many books of reference.

In conclusion, I wish to bear testimony to the zeal of our secretary, without whose enthusiastic co-operation it would have been impossible to have accomplished so much in so short a time. I also have to request that members will aid me, by suggesting any action that may promote the welfare and add to the usefulness of the association.

Yours faithfully,

FREDERIC NICHOLLS,
President.

New York, August 1.

The Growth of the New York Telephone System.

No community in the world appreciates more keenly than this one the appliances and services placed at man's disposal by modern science, especially if they can be had at a moderate price. The introduction by the Metropolitan Telephone and Telegraph Company, whose business in New York city has been taken over by the New York Telephone Company, of a scale of rates for telephone service based on the actual use of the service by the subscriber meant to a large number of actual and possible users of the telephone a substantial reduction in the cost of telephone service. Consequently the past year has witnessed an increase of more than 2,500 telephone stations connected to the New York system. Tastes and requirements regarding telephoning differ as much as in anything else. One man wants to telephone all day long, another two or three times a day, while another practically does not call up at all, but wants the connection so that others may be able to call him. Therefore, a rate of $90 a year and upward, according to use, appeals to a vastly wider circle than a flat rate of $240 without regard to use. Especially as neither the quality of the equipment nor the efficiency of the service has been in the least diminished to provide for the low rates. The $90 subscriber gets his long-distance instruments, his metallic circuit line and rapid service, just the same as the $240 man. Liberty, equality and efficiency is the motto of the telephone company; liberty to kick if anything goes wrong, equality in equipment, and efficiency of service for all. The only difference is that the large user pays a higher toll.

The new rates have proved so popular in the upper part of the city among private residences, uptown business houses and retail stores, that the New York company has installed a detachment of its contract department staff in an office at 113 West Thirty-eighth street, close to Broadway. Uptown customers of the company will henceforward be able to transact all their business regarding telephone service at the new office, saving the journey down to headquarters at Cortlandt street.

A large firm of pump and engine builders in Indianapolis has applied for a receiver, giving as the cause of the assignment the free silver agitation, which, they say, has destroyed their business.

TRUE RESISTANCE.

BY ROLLO APPLEYARD, IN THE LONDON "ELECTRICIAN."

There is one view of the problem of the electric arc which may be worth the attention of those who are trying to interpret experimental work of recent publication. We have been given a concise statement of the conditions which engender the so-called "negative resistance." We have been told that it occurs in arcs formed between solid carbons, simultaneously with back electro-motive force. The first analytical step is to consider the correctness or otherwise of predicating "resistance," under any circumstances, of an arc; leaving out of the question, for the time being, the lesser issue, as to whether the algebraic sign of the assumed resistance is positive or negative.

That which we are in the habit of calling "resistance," and generally represent by R in electrical formulæ, is a conception derived from our experience of homogeneous metallic conductors; *i. e.*, it is a quality of a particular class of conductors. Its most pronounced characteristics are its independence of the current flowing, its independence of the potential of the conductors, and its positive sign. While, however, this conception of this physical quality is primarily derived from our experience of homogeneous metallic conductors, it may probably be rightly extended to some other substances—*e. g.*, to electrolytes, and perhaps dielectrics—on the ground that these obey the same law in the conduction of currents of electricity as metallic conductors; viz., that the current is proportional to the electro-motive force applied, and is in the same direction as the fall of potential. But when conducting mechanisms such as gases, conductors by convection, or arcs are concerned, we are not justified in predicating this quality of resistance of them, without such experimental grounds as justify us in the case of electrolytes.

And when, by assigning the quality of resistance to a conductor, we find that this involves the resistance having a negative sign, we should be prudent to retrace our steps and our language.

No one denies that the arc has a certain quality in virtue of which energy is transformed in it by the passage of a current. We may, of course, represent this quality by R, or by any symbol we please. Without proof we are not justified in speaking of it in connection with the arc, in the same sense as that in which we speak of the defined "resistance" of a homogeneous metallic conductor.

The truth is, we have no rigorous definition of resistance except as an attribute of homogeneous metallic conductors; the "arc" controversy seems to have arisen from the neglect of this fact. The term has been decoyed into the interpretation of results quite foreign to it. Even with the positive sign, "true resistance" has no proven right in equations concerning the arc.

ON HYPERPHOSPHORESCENCE.

BY SILVANUS P. THOMPSON, D. S. C., F.R.S., IN THE "PHILOSOPHICAL MAGAZINE."

The recent researches of H. Becquerel† on the emission by compounds of uranium and by metallic uranium of invisible radiations which very closely resemble those discovered by Wiedemann‡ and Roentgen,§ and which yet unquestionably consist of transverse vibrations, are of so great importance that any experiments upon the same line, however incomplete, are of interest to physicists.

In January last the writer and his assistant, Mr. Miles Walker, were repeating Roentgen's now familiar experiments on the production of photographic shadows by the emanations from Crookes tubes, and were casting about for means to shorten the long exposures then necessary, when the idea occurred to them which has independently suggested itself to many other experimenters—namely, that of employing fluorescent substances in contact with the photographic film to hasten the photographic action by the emission of rays of a visible sort when stimulated by the X rays. Accordingly, having prepared sheets of paper or of aluminum covered with fluorescent material, they tried the effect of inserting them in some cases below the glass plate, in other cases above the glass plate, but with the fluorescent surface next the film, and in yet other cases above the plate, but with the fluorescent surface outside. The materials so tried were sulphide of calcium, finely powdered fluor-spar, sulphide of zinc (natural blende), sulphide of zinc (artificial), fluoride of uranium and ammonium, and sundry platino-cyanides.

When sheets of paper or aluminum covered with these were placed face down upon the sensitive film, so that the X rays were compelled to pass first through them, some results were obtained tending to show that the method might have some advantages, but the resulting negatives were always patchy and irregular. The most striking effect, however, was quite unexpected. Care had been taken to keep these prepared sheets of fluorescent material in the dark for a sufficiently long time for all visible phosphorescence or persistent fluorescence to disappear. This, in the case of the sulphide of calcium, required many hours. The powdered fluor was also heated beforehand. Nevertheless, though no visible phosphorescence was present, the sensitive films were fogged by rays emitted from these materials. Fluor-spar and the platino-cyanides did not produce any noticeable fogging, however. Even after being kept six weeks in darkness, the sulphide of calcium is very active in the emission of rays that will affect a photographic plate.

While these experiments were in progress other experiments were begun, to ascertain if from any other sources, such as sunlight or the light of the arc lamp, any rays could be obtained having, like the X rays, the power of penetrating opaque bodies. From the arc lamp, with an exposure of about two hours, shadows of pieces of metal were obtained on a photographic plate through a piece of pine wood several millimetres thick; but aluminium was found to be totally opaque to everything radiated from the arc and to sunlight.

While the experiments on fogging were still in hand there was published the observation of M. Henry on the effect of sulphide of zinc in apparently augmenting the transparency of aluminum to X rays—an observation which had an obvious bearing on that which was under investigation. A number of small portions of the fluorescent substances with which we were experimenting were then placed upon the front of a sheet of aluminum about 0.5 millimetres thick, behind which was a gelatino-bromide plate (a Cadett's "lightning" plate), and these were left for several days upon the sill of a window facing south to receive so much sunlight (several hours, as it happened) as penetrates in February into a back street in the heart of London. On developing the plate, it was found that behind those spots where portions of uranium nitrate and uranium ammonium fluoride had been placed, photographic action had taken place through the aluminum sheet. No very distinct effect had been produced by the other substances. On communicating these observations to Sir G. G. Stokes, he drew the writer's attention to the similar observations of M. Bacquerel with respect to uranium salts, observations which have since been so remarkably extended. While agreeing with the Roentgen rays in the property of penetrating aluminum, zinc, and other opaque materials, and in exercising photographic actions, the Becquerel rays differ in the circumstance that they can be refracted and polarized. Whatever the Roentgen rays may eventually prove to be, the Becquerel rays consist of transverse waves of an exceedingly high ultra-violet order.

The circumstance that the strongest fluorescent effects are found in the compounds of two metals having such heavy atomic weights as platinum and uranium, when correlated with the other circumstance that the absorbing power towards X rays is greatest in elements of the greatest atomic weights, naturally suggests a new application of the law of reciprocity between emission and absorption. If that law can hold good in the phenomena of the Roentgen rays, or of the closely related Becquerel rays, one would argue that the best substances to employ as emitters of such radiations would be those substances which absorb them most freely. Now, the property of emitting Roentgen rays has been observed in many substances, but always under the stimulation of the cathodic discharge. In Roentgen's original research glass was the radiator. Porter and Jackson independently found platinum foil to be superior. Roiti has found porcelain and mica also to serve. The writer has observed Roentgen rays to be emitted from the following substances exposed to cathode discharges: calc-spar, apatite, rubies, sapphires, diamonds, uranium glass, scheelite, tourmaline, a phosphorescent enamel containing 60 per cent of sulphide of calcium, sulphide of zinc (hexagonal blende), zinc, aluminum, copper, iron, magnesium and platinum. Of the metals in the above list, iron and platinum appeared to work better than copper, aluminum or magnesium. The low melting points of the last two render them unsuitable. Metallic uranium would have been tried had it been possible* to obtain a specimen, but all inquiries in London proved fruitless. Of the other substances named, the phosphorescent materials seemed to have some advantages over ordinary glass, but they are not so convenient to manage as the metals. Apatite was tried because, consisting as it does chiefly of phosphate of lime, it was thought that the X ray emitted from its surface could be more certainly absorbed by bone than are the X rays emitted from denser materials, such as platinum.

At an early stage of these investigations the use of a fluorescent screen revealed the fact that the relative transparency of flesh and bone differed with different materials used as emitters, and depended also upon the degree of exhaustion. The necessary inference that the X rays are not all of one kind, but are heterogeneous, was announced by the writer about the same time† that the same conclusion was drawn by MM. Benoit‡ and Hurmuzescu from other causes. To the rays emitted from apatite, bone was indeed found to be more opaque than to those emitted from platinum. But apatite, when subjected to the cathode discharge, continues to give out gases which after a very few seconds spoil the vacuum; and the tube containing apatite as an anti-cathode could not, consequently, be used except attached to the pump. Glass was found to be more transparent to X rays emitted from platinum than to X rays emitted in the same tube from glass.

The extraordinary property exhibited by the uranium compounds of emitting a persistent invisible radiation that will pass through aluminum and produce photographic action would suggest that these rays are identical with Roentgen's, were it not that Becquerel's success in reflecting, refracting and polarizing them proves that they are more akin to ultra-violet light. The latter does not indeed penetrate aluminum, but it has long been known that ultra-violet rays penetrate films of silver, which, though thin, are thick enough to reflect all visible kinds of light. It would seem to be proved, then, that Becquerel's rays differ from the known ultra-violet in degree rather than in kind, being rays of higher frequency and shorter wave length. That their properties are intermediate between those of ultra-violet and of the Roentgen rays furnishes a strong presumption that the latter also differ only in degree, and are an extreme species of ultra-violet light. It should not be forgotten that so far back as 1857 M. Niépce de Saint Victor observed many cases in which an object, an engraving on paper or a figured piece of porcelain or marble, immediately after exposure to sunlight, was found capable of giving a photographic impression to a sheet of paper prepared with chloride of silver, with which it was placed in contact. He even used, after exposure to light, cardboard imbibed with salts of uranium or with tartaric acid, and found such to be capable of emitting rays that were photographically active. There was no attempt made, however, to investigate the possibility of transmitting these invisible radiations through opaque bodies.

The phenomenon of persistent emission of these invisible rays by the uranium compounds long after any electrical or luminous stimulus has ceased to be applied would seem, therefore, to bear the same relation to the transient emission of them in the Crookes tube as the persistent emission of visible light by phosphorescent bodies does to the transient emission of light by fluorescent bodies, hence the writer ventures to give to the new phenomenon thus independently observed by M. Becquerel and by himself the name of hyperphosphorescence. A hyper-phosphorescent body is one which, after due stimulus, exhibits a persistent emission of invisible rays not included in the hitherto recognized spectrum.

† *Comptes Rendus*, CXXII, pp. 559, 790, etc.

‡ *Zeitschrift fur Elektrochemie*, II, p. 189 (August, 1895).

§ *Sitzungsberichte der Wurzburger Physik-medic Gesellschaft*, 1895.

* [While these lines have been going through the press, a specimen of metallic uranium has been given me by Mr. C. Vautin. It emits X rays freely under the cathode discharge—S. P. T.]

† *Comptes Rendus*, CXXII, p. 807.

‡ *Ibid.*, CXXII, p. 779.

Assignment of H. E. & C. Baxter.

The electrical supply house of H. E. & C. Baxter, Brooklyn, N. Y., on August 3 made an assignment in the interest of their creditors, without preference. They expect to be able to give a showing that will be satisfactory to their creditors, a meeting of whom will be called as soon as an account of stock is taken and the statement showing the condition of the business is completed.

Messrs. H. E. & C. Baxter are well known to the electrical manufacturing field as gentlemen of integrity and industry, and their many friends hope that they will soon recover from their temporary embarrassment.

MANUFACTURING NOTES.

Two suits for $20,000 each have been filed by Ed Morris and wife against the Westinghouse Electric and Manufacturing Company. The son of the plaintiffs, Thomas Morris, was killed by the explosion of an emery wheel, July 22, 1895, at the works of the defendant company.

Japan's Diet voted $45,000,000 for the construction of railroads, telegraphs and cables at its last session, and $97,000,000 for the construction and purchase of war materials and ships. Since January, 1895, $600,000,000 has been invested by Japanese in banks, railroads and other companies.

POLICE AND FIRE TELEGRAPH SUPERINTENDENTS.

A NATIONAL ASSOCIATION TO BE FORMED ON SEPTEMBER 15—SUPT. F. C. MASON, OF BROOKLYN, ISSUES THE CALL.

Away back in the dim mists of antiquity, even at a more remote date than the retentive memory of the oldest inhabitant, some one suggested that in his judgment the superintendents of police and fire telegraph bureaus of the United States and Canada should meet once a year for consultation, enjoy a dinner and conduct themselves generally as other officials do whose duties bring them into close personal relation. The rash individual who broached the subject was at first looked upon with suspicion by his fellow workers, was then tabooed and eventually passed into a nameless grave. It remained, however, for Mr. F. C. Mason, superintendent of the police telegraph system of Brooklyn, N. Y., to start the ball rolling in the right direction with sufficient momentum to reach those interested. He has placed the matter before his brother officials in such a concise and business-like form as to immediately fire them with a desire to make this association the most notable one of its kind in the world.

Letters were sent to the telegraph superintendents of the leading cities requesting co-operation and suggestions. Many replies have been received, all in favor of forming the association. The first meeting has been called for Brooklyn, N. Y., on September 15, and arrangements are being perfected to give those present a most enjoyable time, including a sail on the ocean, fish dinner at Pleasure Bay, and an evening at Manhattan Beach.

Officers for the first year will be elected at this meeting, members elected and an organization perfected. The following gentlemen have, up to the present time, signified their intention of assisting in the work of the new association:

Pittsburgh, Pa., M. W. Mead, superintendent, Bureau of Electricity.
Chicago, Ill., John P. Barrett, superintendent, Bureau of Electricity.
Boston, Mass., Brown Flanders, inspector of wires.
Baltimore, Md., L. Lemon, superintendent.
Washington, D. C., H. R. Miles, superintendent, Tel. and Tel. Service.
Richmond, Va., W. H. Thompson, superintendent, F. and P. Teleg.
Cincinnati, Ohio, J. A. Archibald, fire marshal.
Buffalo, N. Y., Henry Smith, chief operator.
Albany, N. Y., M. E. Higgins, chief.
Troy, N. Y., Jas. Knibbs, superintendent, F. A.
Rochester, N. Y., C. R. Barnes, superintendent.
Macon, Ga., C. H. Humphreys, superintendent, F. and P. Teleg.
Denver, Colo., Julius Pearse, chief.
San Francisco, Cal., Walter Hewitt, superintendent, F. A.
New Orleans, La., Geo. T. Butler, superintendent, F. A.
Omaha, Neb., Geo. A. Coutler, superintendent.
Atlanta, Ga., W. R. Joyner, chief, Fire.
Atlanta, Ga., A. B. Connolly, chief, Police.
St. Paul, Minn., Thos. Carey, superintendent.
Minneapolis, Minn., Z. T. Morrison, F. and P. Tel.
Louisville, Ky., Edward Hughes, chief, F. D.
Savannah, Ga., W. D. Claiborne, superintendent, Police Telg.
Jacksonville, Fla., T. W. Hancy, chief, F. D.
Tampa, Fla., J. F. Ahlers.
Indianapolis, Ind., J. W. Webster, chief, F. D.
Milwaukee, Wis., Jas. Foley, chief, F. D.
St. Louis, Mo., S. J. Benedict, superintendent.
New Haven, Ct., W. C. Smith, superintendent, Police.
Providence, R. I., C. G. Cloudman, superintendent, Fire.
Providence, R. I., N. M. Russell, superintendent, Police.
Portland, Me., L. L. Cummings, city electrician.
Brooklyn, N. Y., F. C. Mason, superintendent, Police Telg.
Toronto, Ont., R. J. McGowan, secretary, F. D.
Montreal, Canada, Z. Benoit, chief, F. D.
Detroit, Mich., W. J. Gardiner, superintendent, Fire Alarm.
Dayton, Ohio, D. C. Larkin, chief, Fire Department.
Cleveland, Ohio, R. L. Palmer, Director of Fire.
Toledo, Ohio, C. F. Wall, chief.
Jersey City, N. J., W. H. Foley, superintendent, Police Telg.
Jersey City, N. J., Jno. Speicher, superintendent, Fire Telg.
Newark, N. J., Adam Bosch, superintendent, F. A.
Atlantic City, N. J., C. W. Brubaker, superintendent, F. and P. Tel.
Charleston, S. C., O. G. Margenhoff, chief, F. D.
Charleston, S. C., W. H. Easterlin, superintendent, Police Tel.
Syracuse, N. Y., Thos. Tyrrell, superintendent, Fire Alarm.
Syracuse, N. Y., M. J. Myers, superintendent, Police Alarm.
Utica, N. Y., J. J. Garthside, chief.
Columbus, Ohio, W. H. Murphy, superintendent, City Telg.
Allegheny, Pa., J. K. Murphy, Department Public Safety.
Elmira, N. Y., W. Y. Ellett, Fire Tel.
New York, N. Y., M. R. Brennan, Police Tel.
Corning, N. Y., F. P. Foster, F. A.
Trenton, N. J., C. E. Drake, P. and F.
Springfield, Mass., S. L. Wheeler, F. and P.
Wilmington, Del., J. W. Aydon, F. and P.
Bridgeport, Ct., W. A. Barnes, F. and A.

Among the many letters favoring the idea, Mr. Mason has received the following, and it is safe to predict that the association will be successfully launched:

I am in receipt of your communication of June 15, in reference to organizing an association of Municipal Police and Fire Telegraph Superintendents. Now, that is the proper thing, and New York the proper place to open the ball.

I am in favor of having the permanent office in New York during the bathing season, but think it ought to be moved South in the Winter time. October is a little bit too late in the season to have your first meeting. Can't you have it in August or September?

In any event I am with you in the good cause, and I know of no man in America who is better qualified to organize a good, all-around entertainment.

Yours sincerely,
(Signed) J. P. BARRETT,
Superintendent of City Telegraph.

Chicago, Ill., June 22.

I am in receipt of your letter in reference to the formation of a National Association of Municipal Police and Fire Telegraph Superintendents of the United States.

I think it is a good move and I most heartily concur with your plan, and will promise you that I will do all in my power to make the association a success.

Very respectfully yours,
(Signed) W. D. CLAIBORNE,
Superintendent Fire and Police Telegraph.

Savannah, Ga., June 24.

Your communication of the 15th inst., duly received. Such an association of Municipal Telegraph Superintendents ought to be of considerable benefit to its members.

I heartily indorse your proposal and will do what I can to further its interests.

Very truly yours,
(Signed) WILLIAM R. HEWITT,
Superintendent Fire Alarm.

San Francisco, Cal., June 24.

Yours, June 23, at hand, and contents noted, and in reply to same would say that I consider the idea a very good one. I think anything that brings individuals of any one craft together will be to the mutual interest of all.

Please advise me of any further move that may be made in the matter, and oblige,

Yours truly,
(Signed) THOMAS CAREY,
Superintendent Fire Alarm.

St. Paul, Minn., June 25.

I beg to acknowledge receipt of yours of 15th inst., re to forming a national association of Fire and Police Superintendents.

In my opinion such an association would be of great value to municipalities throughout the country, as well as to the members individually. You can depend upon my hearty co-operation.

Yours very truly,
(Signed) L. LEMON,
Superintendent.

Baltimore, June 19.

This week a committee, consisting Messrs. Mason, of Brooklyn; Brennan, of New York, and Foley, of Jersey City, will meet and arrange the plans for preliminary organization and a programme for the convention.

ELECTRIC RAILWAY NOTES.

The Hardie air motor was last week tested several times, with apparent success, on the tracks of the 125th street cable road in New York city.

The New York Stock Exchange has listed $5,500,000 5 per cent 30-year consolidated mortgage bonds of the Milwaukee Electric Railway and Light Company.

The following statement of gross earnings of the Brooklyn Rapid Transit Company was issued last week.

	Gross earnings month of July. 1894.	1895.	1896.
Brooklyn Heights R. R. Co.....	$443,856.91	$407,723.48	$431,212.43
Brooklyn, Queens Co. & Sub. R. R. Co.....	53,824.05	64,879.97	68,804.00
Total.....	$497,380.96	$472,603.45	$500,016.43

The increase of receipts over 1894, as will be seen, is less than $3,000, a much poorer showing than it was expected would be made.

The Mayor of Milwaukee has signed the franchise of the Milwaukee & Waukesha Electric Railway. President McDonald says: "We have been ready for some time, but shall now go ahead at once. We shall have the system in operation within 12 months. The line is expected to cost about $2,000,000." New York interests are said to be in this company and that the bonds are likely to be placed in the East. The road to be built will have some bearing upon the Milwaukee Street Railway line, in which the North American company has been interested.

KIND WORDS.

PRAISE FOR THE "REVIEW."

TO THE EDITOR OF ELECTRICAL REVIEW:

We wish to take this opportunity of saying that we have nothing but praise for your paper.

THE JEFFREY MANUFACTURING COMPANY, R. H. JEFFREY.

August 5, 1896.

Edison Electric Illuminating Company of Boston declared the regular quarterly dividend of 1¾ per cent, payable August 1. Books closed July 21 and reopened August 3.

ROENTGEN RAYS OR STREAMS.

(Concluded from page 79.)

place them as closely together as possible. They also showed the fallacy of comparing results obtained with different bulbs.

V—ACTION ON THE FILMS.

Many experiments with films of different thicknesses show that decidedly more detail is obtainable with a thick film than with a thin one. This appears to me to be a further evidence in support of the above views, as the result can be easily explained when considering the preceding remarks.

VI — THE BEHAVIOR OF VARIOUS BODIES IN REFLECTING THE RAYS,

on which I have previously dwelt, will, if verified by other experimenters, leave no room for a doubt that the radiations are streams of some matter, or possibly of ether, as before observed.

VII—THE ENTIRE ABSENCE OF REFRACTION

and other features possessed by the light waves has, since Roentgen's announcement, not yet been satisfactorily explained. A trace at least of such an effect would be found if the rays were transverse vibrations.

VIII—THE DISCHARGE OF CONDUCTORS

by the rays shows, in so far as I have been able to follow the researches of others, that the electrical charge is taken off by the bodily carriers. It is also found that the opacity plays an important part, and the observations are mostly in accord with the above views.

IX—THE SOURCE OF THE RAYS

is, I find, always the place of the first impact of the cathodic stream, a second impact producing little or no rays. This fact would be difficult to account for unless streams of matter are assumed to exist.

X—SHADOWS IN SPACE OUTSIDE OF THE BULB.

An almost crucial test of the existence of material streams is afforded by the formation of shadows in space at a distance from the bulb, to which I have called attention quite recently. I will presently refer to my preceding communication on this subject, and will only point out that such shadows could not be formed under the conditions described, except by streams of matter.

XI—ALL BODIES ARE TRANSPARENT TO VERY STRONG RAYS.

Experiments establish this fact beyond any doubt. With very intense radiations, I obtain, easily, impressions through what may be considered a great thickness of any metal. It is impossible to explain this on any theory of transverse vibrations. We can show how one or other body might allow the rays to pass through, but such explanations are not applicable to *all* bodies without exception. On the contrary, assuming material streams, such a result is unavoidable.

A great many other observations and facts might be added to the above, as further evidence in support of the above views. I have noted certain peculiarities of bodies obstructing a cathodic stream within the bulb. I have observed that the same rays are produced at all degrees of exhaustion and using bodies of vastly different physical properties, and have found a number of features in regard to the pressure, the vacuum, the residual gas, the material of the electrode, etc., all of which observations are more or less in accord with what I have stated before. I hope, however, that there is enough in the present lines to enlist the attention of others.

NIKOLA TESLA.

New York, August 11, 1896.

ADVANCE INFORMATION

Valuable News and Tips for Manufacturers and Dealers.

We publish below information relating to new electric railways, new electric light companies, new telephone companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW.

New Electric Railways.

SPRINGFIELD, VT. — Work has begun on the Springfield Electric Railway. It will be built from Springfield to Charleston, N. H., a distance of eight miles. W. H. Slack, G. F. Leland and E. B. Flinn are interested.

BRENTWOOD, N. Y.—The State will build an electric railway to connect the asylums at King's Park and Central Islip.

LANGHORNE, PA.—An electric railway is to be built between Langhorne and Frankford.

AMHERST, MASS.—An electric road is contemplated from this place and Sunderland.

LYONS, N. Y.—The Wayne County Traction Company has been incorporated by Orlando F. Thomas, D. N. Johnson, F. K. Harris, Athens, Pa., and Burton Hammond, Chas. T. Ennis, Clermont R. Sherwood, Lyons, N. Y., to build an electric railway from Lyons to Newark. Capital stock, $60,000.

ROCKVILLE, CT.—The Rockville & Ellington Street Railway Company are making a survey for an electric railway to connect Rockville and Talcottville.

CHATTANOOGA, TENN.—The Chattanooga Electric Street Railway Company has proceeded to occupy the forfeited streets under the recent resolution of the Board of Aldermen and the Mayor.

PETERSBURG, VA.— The Petersburg Electric Railway Company has filed a deed of trust to secure its bonds.

HOLLAND, MICH.—The Mayor may be addressed concerning construction of an electric road to Macatawa Park.

DETROIT, MICH.—Detroit Street Railway franchise has been held to be valid by a decision of the Supreme Court denying the right of the Detroit Citizen's Railway Company to the exclusive right to the streets of the city, as claimed under an old ordinance.

BALTIMORE, MD.—Arrangements have been made for proposed extension of city and suburban line. To build from Mt. Holly, its present terminus in the northwest, to Electric Park. Rights of way nearly all secured. Urged to construct the line by President Fenneman and the people of West Arlington.

HUDSON, MASS.—George A. Tripp and others are interested in the construction of an electric road between Lancaster, Bolton and Hudson, to cost $100,000.

KANSAS CITY, MO.—The Northeast electric street car line, with all the property belonging to the company, will be sold on the 30th, under foreclosure.

CHICAGO, ILL.—A new power house to cost $250,000 will be erected.

MILWAUKEE, WIS.—Arrangements have been made by the street railway company for remodeling the Edison power house during the next three months, at a cost of $50,000.

YOUNGSTOWN, OHIO — There is some talk of a new electric line from this place to Niles.

GREENPORT, L. I.—The scheme to build a trolley road from here to Orient has been revived. The cost is estimated at $150,000.

SHELBURNE FALLS, MASS.—The street railway has given the contract for the electrical apparatus to the Hawks electrical company, of Boston.

SPRINGFIELD, MASS.—It has been announced that the Enfield and Longmeadow Electric Railway Company, organized about four years ago to operate in Northern Connecticut and Southern Massachusetts, is to be re-organized at New Haven with a capital of $125,000. New York, New Haven, Boston and Springfield capitalists are interested. The new company proposes to extend a line from just beyond the Massachusetts State line through Connecticut to Thompsonville.

WARREN, OHIO—The Mahoning Valley Electric Railway Company will equip its entire line with a telephone system. Each street car will be furnished with a telephone instrument which can be attached to the "plugging in" boxes, that have connections with the copper telephone wires.

HOUSTON, TEX.—The Houston City Street Railway Company has been reorganized under the charter title of the Houston Electric Street Railway Company. A charter has just been granted, fixing the capital stock of the new company at $2,000,000. Directors and officers: The directors are A. N. Perrin and George E. Smith, of Boston; Austin Corbin, of New York, and Albert H. Hayward, H. C. Chase, J. H. Kirby, T. W. House, W. D. Cleveland and E. P. Hill, of Houston. The officers are A. N. Perrin, president; Austin Corbin, vice-president; H. C. Chase, secretary.

AUSTIN, TEX.—Houston Electric Street Railway Company has been incorporated. Capital stock, $2,000,000. Directors, Albert N. Partin and Geo. E. Smith, of Boston; Austin Corbin, of New York; T. W. House, W. D. Cleveland, John K. Kirby, A. H. Hayward, H. C. Chase and E. P. Hill, of Houston.

Electric Light and Power.

VICKSBURG, MICH.—A new electric light plant is to be constructed. Contract was to be let August 10.

ANNISTON, ALA.—J. O. Keith is making arrangements for the establishment of an electric plant to generate electricity from water for distribution to factories, etc.

BARNESVILLE, GA.—Address the Mayor concerning the construction of an electric light plant, for which $7,000 worth of bonds will be issued.

LAFAYETTE, LA. — Address the Mayor concerning the construction of an electric light plant.

CONCORD, N. C.—The Concord Electric Light Company will add new boilers and other machinery to its plant.

BERKLEY, VA.—The Berkley Electric Light and Power Company has been incorporated, with E. M. Tilley, president; H. J. Palmer, vice-president, and Benjamin Tilley, secretary-treasurer. Capital stock, $50,000.

MANCHESTER, VA.—Address the Mayor concerning construction of an electric light plant.

FRESNO, CAL.—Stockton & San Francisco Electric Power Company has been incorporated by L. E. Walker, S. Wormser, F. Younggren, J. C. Sheppard, Chas. G. Bonner. Capital stock, $5,000,000.

ST. AUGUSTINE, FLA.—The St. Augustine Gas and Electric Light Company is moving into its new quarters in the Lyon Building.

SANTA CLARA, CAL. — Bids are being opened for the construction of an electric light plant.

KANSAS CITY, MO.—The Northeast electric line is to be sold under foreclosure.

CLEVELAND, OHIO—Century Power and Lighting Company has been incorporated by E. W. Smith, Albert Straus, Hiram Straus, A. B. Pinney, F. Barkoske. Capital stock, $10,000.

CROSWELL, MICH.—Croswell Electric Light Company has been incorporated with a capital stock of $10,000.

CHEBOYGAN, MICH. — Cheboygan Electric Light and Power Company has been incorporated with a capital stock of $100,000.

GRENADA, MISS.—Jas. Pryor & Company, desire bids for a small electric light plant for lighting a store.

NORTH CRAMERS HILL, N. J.—Young & Bailey, engineers, Philadelphia, Pa., are reported to be preparing plans for the construction of an electric light plant in this city.

EAST PALESTINE, OHIO — John Archibald, City Clerk, may give information concerning construction of electric light plant, for which $10,000 worth of bonds will be issued.

BATH, ME.—The Bath Gas and Electric Company will enlarge its plant.

QUINCY, ILL.—The Des Moines Rapids Power Company is reported to be making arrangements for constructing a power plant, to cost about $750,000, near the Keokuk Rapids.

FARMINGTON, ME.—The Farmington Electric Light Company has been organized, with E. S. Dingley, of Farmington, president; J. P. Flint, of Farmington, treasurer; for the purpose of making, generating and distributing gas and electricity for lighting and power. Capital stock, $10,000.

AMHERST, MASS.—Putnam & Bayley, architects, have prepared plans for the new electric light station. The building will be 108 feet long and 45 feet wide.

CRAIG, MO.—Steps are being taken to establish an electric light plant.

HAMILTON, ONT.—Contract Power Company has been incorporated by J. M. Gibson, James Dixon, John Moodie, John W. Sutherland, John Patterson, E. D. Patterson, all of Hamilton. Capital stock, $99,000.

HEMPSTEAD, TEX. — Address the Mayor concerning construction of electric light plant.

GREENSBORO, ALA. — Robert F. Otts desires prices on plant for lighting, with electricity, town of 2,000 inhabitants.

SAN FRANCISCO, CAL.—Paul Jarboe and J. J. Crooks, capitalists of this city, have purchased a controlling interest in the Tuolumne Electric Light and Power Company, located on the Tuolumne River at Columbia Hill.

New Manufacturing Companies.

ROANOKE, VA.—A charter has been granted to the Roanoke Car Fender Company for the purpose of manufacturing, selling and placing fenders on cars, with a capital stock of not less than $24,000 or more than $50,000, with the chief office at this place. S. S. Brooks, president; Jesse W. Bell, vice-president; W. P. Dupuy, secretary and treasurer. Directors: C. A. McHugh, W. P. Dupuy, M. P. Crawford, J. E. Young and John H. Wright.

DETROIT, MICH.—The Commercial Supply Company, manufacturing electrical supplies, has been organized and incorporated with a stock of $1,500 paid in, held by Perry E. Phillips and A. A. and George L. Robinson.

CAIRO, ILL.—Egypt Electric Company has been incorporated by William Kluge, Henry Hasenjaeger, Albert Lewis, C. V. Neff. Capital stock, $40,000.

LA CROSSE, WIS.—The Pacific Electrical Company has been incorporated by N. Haskell Withee, O. F. Espersen, W. W. Withee, Forrest J. Smith and Helmus W. Thompson. Capital stock, $7,000.

New Telephone and Telegraph Companies.

OLNEY, ILL. — Richland County Telephone Company has been incorporated. Capital stock, $25,000. Incorporators, Edwin E. Crebs, E. J. Briswalter and C. M. Brock.

SPRINGFIELD, N. Y. — The Bell Telephone Company is putting in a local exchange at this place. Woodside Farm at Mortons Corners has also been connected with the village by wire.

The Reploglе Governor Works, Akron, Ohio, will furnish all the water-wheel governors for the Portland, Ore., General Electric Company's water power plant.

C. F. Splitdorf, 17-27 Vandewater street, New York, has recently perfected designs and is now making a form of induction coil for X-ray work which has been very highly commented upon by a number of experts.

The Holyoke Envelope Company, of Holyoke, Mass., has sent the ELECTRICAL REVIEW two pocket envelopes of different sizes that are just what their name implies and very desirable in a newspaper office or in an editor's pocket.

The John A. Roebling's Sons Company, Trenton, N. J., is sending out a folder containing photo-engravings of sections of three remarkable street railway cables made by the firm. One of these ran 100,560 miles in 419 days, beating all previous records.

The Standard Paint Company, of New York, has just issued a neat little catalogue illustrating and describing "P. & P." Ruberoid Roofing. This is one of the best building coverings ever brought out, and its immense sale attests its popularity. The new pamphlet gives full directions for using and is supplied free.

The Central Electric Company, of Chicago, has sent the ELECTRICAL REVIEW a very artistic picture representing a beautiful Grecian maiden laying a crown on a Lundell fan motor, mounted on a beautiful pedestal. The picture is entitled, "To the Victors Belong the Spoils." Every one who has sat in front of a Lundell fan motor these hot days will heartily favor all the kind words that are said for it.

The White Rock Ozonate Lithia Water, of which Mr. Frank T. Huntoon, of 16 West Twenty-fifth street, New York, is eastern agent, is rapidly succeeding to the popularity of apollinaris as the giant among table waters. This water is from the White Rock mineral spring at Waukesha, Wis., and, besides being a delightful table water, is one of the best cures for rheumatism and solvent for uric acid that is on the market.

The electrical department of Standard Thermometer and Electric Company, Peabody, Mass., has grown to such an extent that it has necessitated the construction of a new building adjoining the present factory, which will be used exclusively for the production of the well known Upton arc lamps. This company are now manufacturing also the Heinze alternating-current fan motors, which are self-starting, self-oiling, sparkless and of high efficiency, running on any alternating incandescent-lamp circuit at either 600, 1,250 or 1,500 revolutions. The Boston office of the Standard Thermometer and Electric Company is in the John Hancock Building, and the New York office at 39 Cortlandt street, New York, under the charge of H. D. Bayne & Company.

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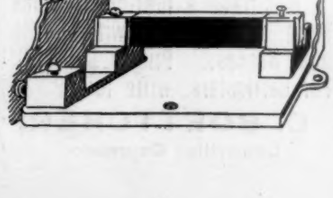

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ELECTRICAL PATENTS

ISSUED JULY 28, 1896.

564,629 Electrical propulsion of canal boats; A. C. Mather, Chicago, Ill.—A rigid elevated track, a trolley traveling thereon, a flexible line extending from the trolley to a canal boat, and means for taking up the slack in said line, whereby the boat may be guided by said trolley and electrical connection.

564,642 Igniting device for gas engines; A. J. Pierce, Grand Rapids, Mich.

564,657 Water sterilizing apparatus; H. G. Stiebel, St. Louis, Mo.—A suitable casing, a filter chamber and clear-water chamber, suitable inlet and outlet openings for the filter and an electric resistance coil confined within the filter chamber.

564,679 Back connection for switchboards; A. J. Wurts, Pittsburgh, Pa.—A plurality of connecting devices for switchboard back terminal studs having base or body portions in alignment in one plane, and conductor sockets located in a plane at right angles thereto.

564,683 Electric signal; W. Daves, Jersey City, N. J.

564,702 Alternating-current generator; B. G. Lamme, Pittsburgh, Pa.—A polyphase, multipolar generator having a field magnet and an armature, the number of poles in one of these members being two more than the number of poles in the other, and a closed coil upon the armature.

564,703 Alternating-current generator; B. G. Lamme, Pittsburgh, Pa.—A radial pole armature having one more pole than the field magnet of the generator.

564,717 Electrical soap; H. E. Rider, New York, N. Y.—A piece of soap with the electrodes of an electric battery placed therein, the soap being provided with an opening through which water may have access to the electrodes of the battery.

564,723 Incandescent electric lamp fitting; E. F. A. Soleau, Paris, France.

564,743 Dynamo-electric machine and electric motor; W. B. Elliott, Westfield, N. J.—An armature for dynamo-electric machines and electric motors, the coils of which are provided with supporting frames, and independent cores that are adapted for insertion in and removal from the coils and frame.

564,748 Process of nickel-plating; H. L. Haas, New York, N. Y.

564,771 564,772 Electric arc lamp; W. C. Armstrong, New York, N. Y.

564,811 Secondary electric clock; J. H. Wilson, Rockwood, Tenn.

564,858 Electric metal separator; H. H. Whitacre, Wellsville, Ohio—A pipe, a valve sliding in said pipe and having a stem which projects without the casing for manually operating the same, and magnets upon said pipe having pole pieces projecting within the same and adapted to electrically operate the valve.

564,867 Electric rack locomotive; D. L. Barnes, Chicago, Ill.

564,902 Electric motor support; S. H. Short, Glens Falls, N. Y.

564,907 Electric arc lamp; B. B. Ward, New York, N. Y.—Feeding mechanism, a circuit breaker and closer actuated mechanically thereby and placed in the circuit of the feed-regulating derived circuit coil, said circuit breaker and closer being adjusted to normally maintain the circuit, but to break it when the arc lengthens or the lamp goes out of action.

564,944 Electric transformer; F. L. Sessions, Fort Wayne, Ind.—A laminated transformer core comprising an annular or polygonal peripheral portion, and three or more inwardly extending limbs radiating at equal angles about the central axis of the core, each lamina being formed of a plurality of like sheet-metal punchings equal in number to the number of said limbs and having limb-forming tongues interfitting with each other at the center of the core, the alternating laminas being arranged to break joints.

564,951 Electric current regulator and distributor; A. H. Washburn, Brockton, Mass.

ISSUED AUGUST 4, 1896.

565,046 Telephone switchboard; A. Stroinberg and A. Carlson, Chicago, Ill.—The combination with the board or standard provided with holes for the insertion of the connecting plugs, of springs of different lengths and extending perpendicular to the rear face of the board, said springs being provided with right-angled extensions, screws extending from the front of the board through said extensions, and nuts upon the ends of said screws and against the extensions of the springs.

565,053 Electrical fire-alarm system; C. D. Tisdale, Boston, Mass.—A compound conductor for electric fire-alarms, consisting of a core wire of metal fusible at a low temperature, an insulating material covering said wire, a second wire wound around said insulating material and an outer covering of insulating material surrounding the whole, said insulating coverings being readily destroyed by heat.

565,056 Electro-therapeutic apparatus; H. E. Waite, New York, N. Y.

565,085 Conduit for electric railways; C. D. Mattison, New York, N. Y.—A closed conduit containing a conductor mounted in insulated supports, a contact-carrying arm mounted in one of the side walls of the conduit, and having a rocking motion and arranged to make contact with the conductor, and trolley contact arms supporting a contact rail and having a movable connection therewith.

565,102 565,103 Electric railway; H. Brandenberg, Chicago, Ill.—The combination with the conduit having the continuous upwardly extending side with a longitudinal groove therein outside of the conduit chamber, of the slot rail overlying the side of the conduit having its rear edge confined in said groove and fastening devices for retaining said slot rail in place.

565,137 Electric soldering iron; F. H. Date, J. Heffron, J. Scudder and B. H. Scranton, Detroit, Mich.—The combination in an electric soldering iron, of the crank shaft, the contact-maker and conducting wires, and the handle surrounding the bend of the crank shaft and the tube connecting the contact-maker with the brace carrying the soldering tube, whereby the two may be moved simultaneously.

565,155 Electric motor; J. Conner, J. R. MacMillan and A. J. Fuller, Philadelphia, Pa.—A novel feature of this motor is the device for preventing lateral movement of or upon shafts or axles.

565,240 Underground trolley system; R. E. Sherman and D. E. Kenyon, Chicago, Ill.—The combination with the slotted conduit of a housing therein containing longitudinal slotted tubular openings for the outgoing and returning conductors of the line, and a bifurcated trolley device comprising conducting arms branching from the trolley pole and terminating in contacts and straddling said housing to enter said contacts into said tubular openings through their slots from sides of said housing.

565,244 Circuit-breaker; W. E. Tobey and H. W. Smith, Pittsfield, Mass.

565,269 Globe for electric arc lights; S. Heimann, New York, N. Y.

TRADE NOTES.

The F. J. Pearson Manufacturing Company, of St. Louis, have prepared for the general trade a portable X-ray apparatus for physicians, professors and students.

The Bliss School of Electricity, of Washington, D. C., are now established in the new Bliss Building, and equipped for the most thorough instructions in practical electrical engineering.

Transure & Williams, Alliance, Ohio, have now in operation their new plant for manufacturing drop forgings in copper, steel or iron. This company devotes attention to forgings of difficult manufacture.

The Card Electric Motor and Dynamo Company, Cincinnati, have completed the installation of generators for operating the presses in the new building for *Munsey's Magazine*, at New London, Ct. This company are now installing an electric plant for the Chicago *Journal*. The New York *Journal* has had in operation for six months an electric equipment perfected by the Card company.

A year ago the Canarsie and Rockaway Railroad Company notified the Nassau Electric Railroad Company to protect the crossing at Rockaway Avenue and Canarsie by building and operating a switch tower. The year was up last week, and no attention, it is said, has been paid to the notification by the Nassau railroad. The Canarsie Company will soon begin suit to compel the Nassau road to show cause why it should not build a tower at that point.

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REFERENCES: "Electrical Review," New York; Paul Cromlein, Teller Lincoln National Bank, Washington, D. C.; Judge Geo. D. Parker, Berkley, Va.; Second National Bank, Washington, D. C.; E. K. Leech, U. S. Mint, Philadelphia, Pa.; W. F. Newell, Manager and Secretary Water Works, Olympia, Oregon.

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TO THE EDITOR OF ELECTRICAL REVIEW:

The writer frequently finds it convenient to consult your esteemed publication when in search of information on various subjects, and begs to assure you of his high appreciation of the ELECTRICAL REVIEW.

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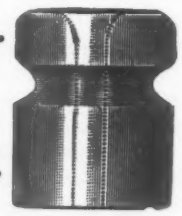

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